# ELECTRICAL REVIEW

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 3, No. 22. WEEKLY. NEW YORK, THURSDAY, JANUARY 31, 1884. $3 per Annum. Single Copies, 10 Cents.


Copyright, 1883, by DELANO & COMPANY, 23 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

## Interesting Features of the Munich Exhibition.

Last year, when the Exhibition of Electricity opened at the Munich Crystal Palace, it will be remembered, a great many electricians, in France as well as abroad, did not believe at first that it would ever attain anything like the importance it was destined to have. Indeed, in spite of the celebrated experiment which Mr. Marcel Deprez had begun, and the result of which was expected by everybody, it could not *a priori* be believed that since the Paris Exhibition the progress had in electrical science were such that a general study could be resumed with much profit.

The machines, arc lamps, and incandescence lights exhibited, down to a very few exceptions, were already known. Serious trials of them had been had, and it was difficult to foresee what new experiments could be made.

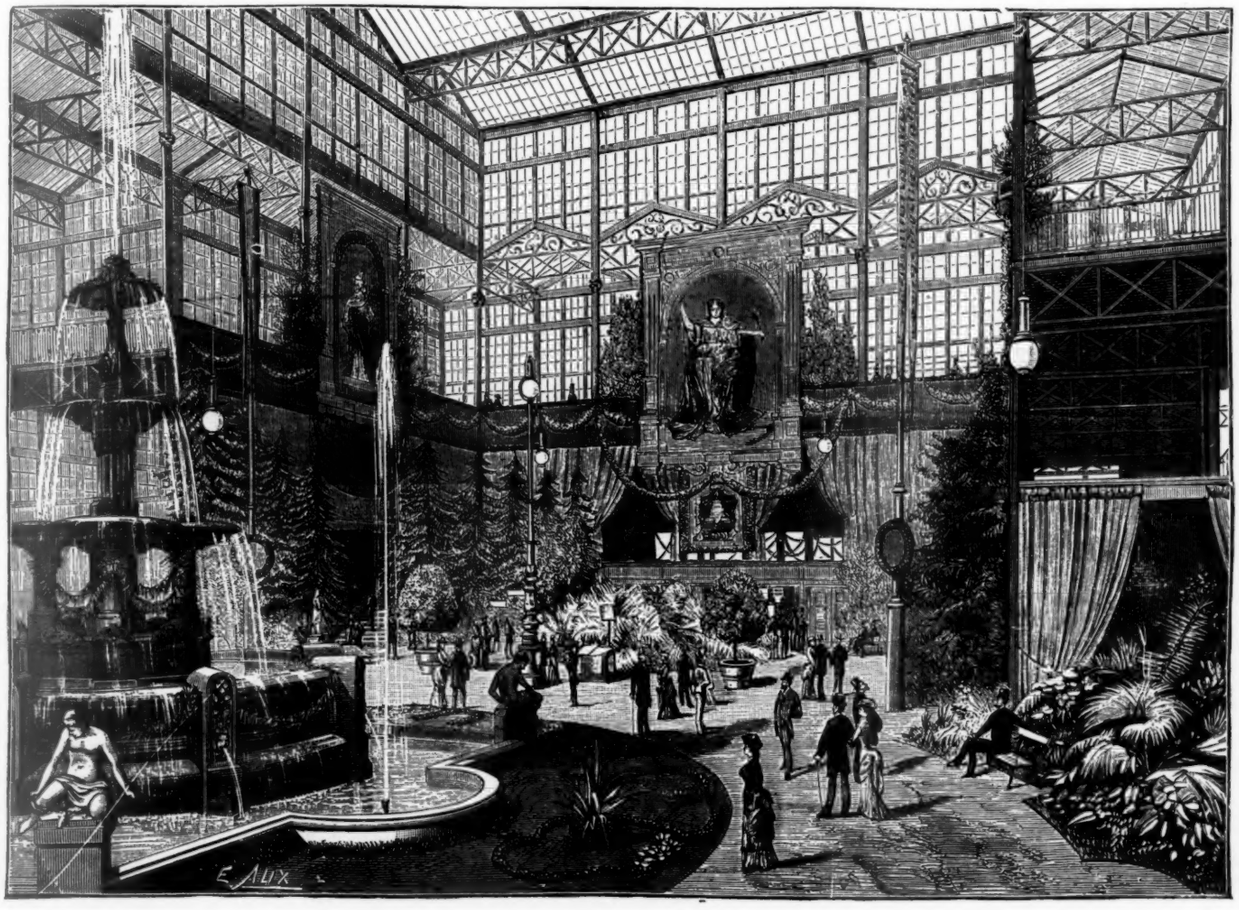
Consequently the Munich Exhibition looked then as if it were destined to be only a pale copy of its predecessors, when, in reality, it was announced by its very title name as a supplement of what had been done before. Outside of the electrical transportation of power at great distance, it was not expected that any new invention would come to light; the purpose was merely to study in a serious manner the sundry industrial applications of electricity, and that in every way and form. It was intended to bring on the apparatus, ancient and recent, exact figures, such as to constitute a precise base for future researches. The end proposed was reached, and success crowned the efforts of the electro technical committee. Among all the essays undertaken and the applications realized in the Crystal Palace, the most complete study was that of lighting by means of electricity.

By previous articles and authentic engravings, the readers of this collection know that, at the very entrance of the exhibition, the comparative use of arc lamps and incandescent lights for the lighting of streets, squares and gardens had been realized; and, notwithstanding the numerous articles which have appeared in this paper on that subject, there remains something to relate in order to complete this review.

First on the list, there is one item that has, we believe, not yet been gone into, although it has struck many visitors; it was in relation to the general lighting of the gardens which occupied the center of the Palace.

Numerous arc lamps of great power have been skillfully disposed in the upper parts of the edifice; projections of diverse colors were lighting up in a fairy-like manner the cascades of the fountain, and though the trees, structures, apparatus did not bear any shade of their own, the brightness of the light was not as full as it might have been desirable. Entering the exhibition, even after going through *Arcis Strasse*, lighted by incandescence, the eyes of the visitors were not yet used to the intense light, the retina had preserved its middling dilatation, and, nevertheless, after having passed the door, the impression of a warm and abundant light was not felt. The engraving above, which represents the entrance door and a part of the main fountain, is, in that point of view, of a complete exactitude. It gives the idea of a diffuse light, similar to that of the day, the brightness of which was hardly surpassed in the reality. The number of lamps might have been doubled, and, without hurting the eyes, the general effect would have been greatly improved thereby.

Having said this much, let us cross the Palace in its whole width; let us not stop to consider the brilliant points to which we will return presently; and, passing under artistically decorated arcades, let us enter the garden of the restaurant. There the decoration did change. Swan's lamps, disposed upon two iron semicircles covered with hops, garlands, illuminated in a very agreeable manner the small central pond, brackets and chandeliers projecting the same light, and showed the entrance of original grottoes, in which the customers were seated, whilst arc lamps, from the top of the lofts of the building, spread a bright light on the points on which incandescent light would have left some obscurity. In the background was the great hall covered with canvas, which constituted in reality the restaurant itself. In its whole width it was lighted with incan-




THE MUNICH EXHIBITION GARDENS.

descent lights of Edison's system. The chandeliers, ten in number, were carrying each twenty lamps of *A* type, and were placed at a middle height of four yards, in such a manner as to produce that improved luminous effect without incommoding the customers. Under the artistical point of view, there were not many observations to be made. The style of the chandeliers and brackets, although most simple, was not deprived of a certain elegance, and harmonized pretty well with the general decoration of the restaurant. In the point of view of the effect, the result was very satisfactory, and the general view of the lighting left very little to be desired. I know very well, it is true, that every evening at six o'clock, at the moment when the public had no access into the Palace, the employes carefully replaced all the lamps out of use by accidental rupture or else by long continued use, and that, in reality, the apparatuses were frequently renewed, but such details are of no consequence whatsoever, when we confine ourselves, as I do now, to ascertaining the effect produced. Now then, on that subject, the purpose had been accomplished, the light was what it ought to have been, neither too weak, nor too bright, and thus lighted the *buffet* (restaurant) did give a very correct and very clear idea of a practical, yet very serious application.

It is certain, however, that in order to correctly appreciate and judge an application of that kind, the economical side of the matter ought not to be neglected; for a manufacturer it is very important, undoubtedly, to know the cost of a new installation, but that side of the question has been elucidated long ago, the figures published by the Committee can serve as a base for the applications, so I need not refer to that again. An exhibition, even of electricity, is made for everybody. It does apply to technical men only; it has, moreover, for purpose to vulgarize (popularize) science, and to place the progresses realized within the reach of all by showing under every form and manner the practical applications offered to manufacturing.

Down to a few exceptions, incandescent lights do not yet constitute but a lighting of luxury. Their soft and fixed light is specially convenient for closed spaces of a moderate extent, museums, art galleries, etc., and in such an order of ideas the artistical side can by no means be lost sight of. Though aiming at a purpose purely practical, the Munich Exhibition could not forget that manifestation of the decorative art, while preserving its serious and scientifical character, it intended to show all the divers effects which can be produced with electric light by a tasteful disposition of it in accordance with the case presented.

To that effect, on the lateral parts of the palace, a series of boxes had been disposed in such a manner as to offer the aspect of small rooms in which the public might appreciate the applications of the different kinds of incandescent lights for the lighting of apartments. Each one of those rooms offered a special aspect due to the variety in the style of their furniture; the most delicate taste had presided over their arrangement and the disposition of the lamps, skillfully distributed, varied from one box to another. Four of those cabins, above all, were remarkable for their luxury and the beauty of the furniture therein contained; they had been fitted up by the Bavarian Union of Arts and Trades, who had very graciously placed at the disposal of the electro-technical committee a great many objects of different kinds, gathered for a lottery, among which were many masterpieces of the little art industry which flourishes in Bavaria. The idea of the small exhibition was due to the amiability of Mr. Francis von Scitz, the manager of the Bavarian Union, who had been seconded in that circumstance by the architect, Francis Brochier, and Mr. Packle, the keeper of the Society.

One of those apartments represented a patrician chamber of the seventeenth century, in regard to the main part of the furniture, whilst the decorations were modern and of a style less pure. The hangings of the back side of the room were severe, their plain colors agreed harmoniously with the general character of the furniture, and in one of the sides the simulachre of a window in the form of a turret increased, yet the severe aspect was impressed on the whole. That parlor, as well as the neighboring one, which offered the aspect of gathering of luxurious furniture, carpets and statuettes, were lighted with incandescence lights by the Edison's Electric Society of Paris. The lamps were suspended on very carefully wrought chandeliers, and a few chased brackets fixed on the side walls. To allow a comparison to be made, the first room was lighted only by six candles, lamps of the A type, whilst the B type of eight candles was reserved for the second.

In that manner, the intensity of the light was not the same in both cases, the parlor with its severe character had less light, and the carvings of its furniture, the shades of which were respected, reassorted in a manner more distinct and bright than a too abundant light would have allowed. The lighting of sculptures in general, and of carved furniture, especially, requires indeed a quite special disposition.

The question here is no longer about an industrial application, wherein the purpose consists in avoiding as completely as possible the shade of the objects, one over the others. If in an office or any other working-room, there is an interest in having the light distributed with the greatest uniformity, it is no longer so when the question is about objects of art wrought with the chisel. Every body, in fact, knows that it is by the action of the shades that the salient parts of a carved piece will resort from the whole, and that it is only under skillfully disposed light that all the plans of a masterpiece can be appreciated. An abundant and erude light is not the objective looked for; on the contrary, it must be soft and colored, bright enough to strike the salient parts, but not intense enough to destroy the shades projected in that point of view. The incandescent lights produced an excellent effect, and their use, as it was made in that circumstance was, beyond cavil, one of the most skillfully arranged.

The two other parts, fitted up by the *Bavarian Union of Arts and Trades*, did not present anything very salient. Swan's lamps lighted the one and Maxim's lamps the other. Except the disposition and work of the chandeliers, the effect produced was nearly the same. For a well-trained eye there was an appreciable difference. On account of the relative size of the carbons, Maxim's lamps will give a more intense light than Swan's; and thus, with a moderate intensity, the light will be slightly rosy, because the white incandescence was not completely reached.

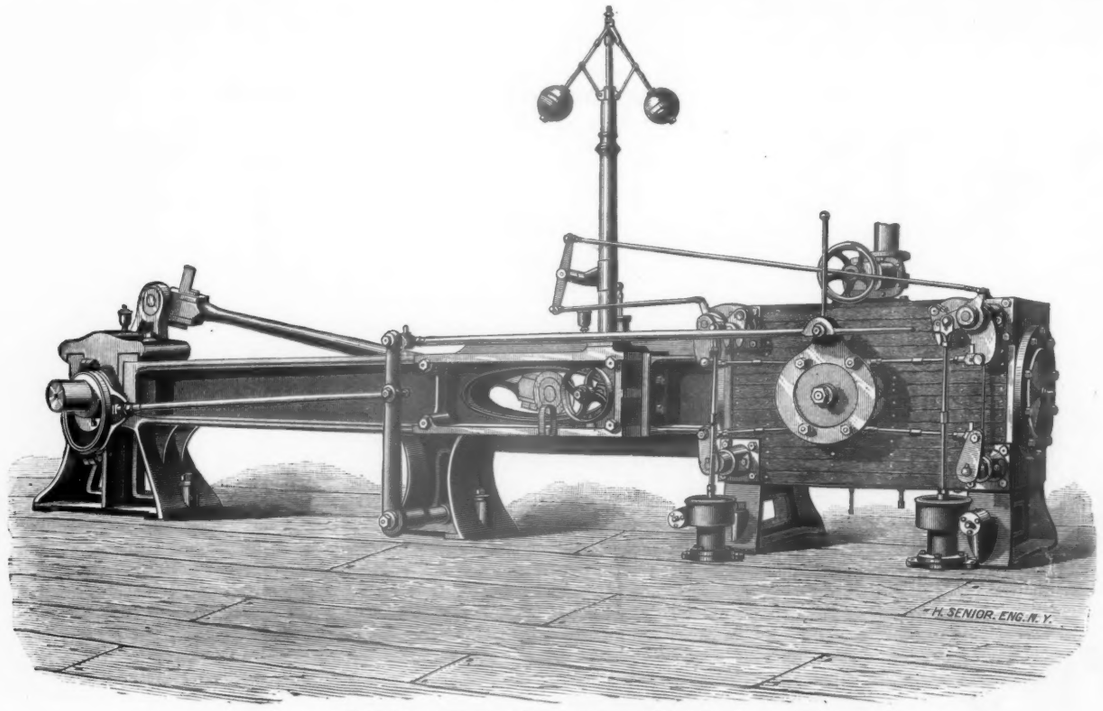
On the opposite side, four rooms similar to those described above had been disposed, which were lighted by the firm Riedinger, of Augsbourg, by means of Muller's incandescence lights (of Hamburg). One of them represented a dining hall in oak of the *Renaissance* style. The furniture therein was very remarkable; Mr. Possenbacher, the Court purveyor, to whom it was credited, had taken special care to give, even in the smallest details, the stamp of the epoch; very elaborate wainscotings surrounded the room, and, without speaking of the panelings and shelves, the entrance door, surmounted South Germany cherished towards the end by the traditional hart's horn, was of a most grand effect.

All the monumental parts of the small room now under consideration were inspired by the marvels of those times, and constituted, with the marquetry—furniture which of the sixteenth century—a polychrome decoration perfectly composed. An old luster in rock crystal gave that room a quite special attraction, and its decorative power was yet enhanced by the incandencent lights hanging therefrom. The antiquary, Spengel, furnished the old lustre, the marquetry ceiling was from the banker Rudem, and the potter, Joh. Graf, was represented by a large green oven of his manufacture. As it appears, it was a queer mixture which would not be easily composed anywhere, upon which the radiation of electric lamps was to be studied. The light of the arc lamps penetrated through the window as a ray of the moon, and the multiple colors of those objects gathered therein, and glaring with strange tones, gave the visitors a genuine feast of light.

Before terminating this review of the experiments on incandescent lights for the illumination of apartments, we must refer to one more of the practical examples which the Munich Exhibition offered. That was the representation of a manager's office in a factory, installed with modern furniture, quite simple, of Bavarian manufacture, and in which the builder, Schönemann, had introduced a series of office electrical installations—control and surety apparatuses, autographic press moved by electricity, and altogether lighted by Edison's lamps. The effect produced was, as it ought to have been, excellent, and once more the good results of the use of incandescence for that kind of lighting was demonstrated.

Finally there was one more cabin, which was totally different from the others, and did not touch electricity on any side. The organizers of the exhibition did not know what to put therein, and it might have remained empty if the antiquarian Spengel had not conceived the happy idea of profiting of that unused space to recall, amidst that modern luxury, a forgotten remembrance of olden times. He had, with meticulous care, composed a poor old gothic chamber, with its table, cupboard, garret windows, low door with heavy iron hinges, just as poetical readings of those times might have suggested to the imagination. In the midst of that concert of brilliant light which enveloped the Crystal Palace, that old dwelling, lighted with a single small candle, came to strike a sad note, which, by recalling the thoughts of those far back times, caused the visitor to appreciate the gigantic way human progress had gone over.

As it may be seen, the Munich Exhibition had exerted all its power to study electricity under all its forms, and to show rapidly, by multiple specimens, all the uses of that fluid, the essence of which is yet unknown. In a city like the capital of Bavaria, the artistical side could hardly have escaped the attention of the organizers, and this rapid report, together with the communications of Dr. Toulages, which were heretofore published in this paper, will satisfy the reader that Munich, the Gothic Munich of Joseph Maximilian, could still, in the middle of her practical researches, show to every one that, without remaining backward on the way of progress, she could in the artistical world preserve her ancient reputation.—*La Lumière Electrique.*




18″ x 42″ Reynolds' Corliss Engine—Back View.

## The Improved Reynolds-Corliss Engine for Driving Dynamo Machines.

We have on several occasions pointed out in these columns that to meet the special work of motive power in installations very few of the engines now in use, however well designed for general work, have been found adapted to the work required of an electric light engine.

A few firms have made the necessary modifications in their present style, or designed engines to meet the special conditions of this field. Messrs. E. P. Allis & Co., of Milwaukee, have been for some time past making engines for the special purpose of driving electric light plants, and the recent successful trial of one of their 32x60 condensing engines, which furnished power for 3,000 incandescent lights at the late Exposition at Louisville, and several smaller sizes now in use in this field at Milwaukee, La Crosse, Louisville and other points, has excited considerable interest. It is now over five years since the Reynolds-Corliss engine was first offered to the public, as one which combined in the highest degree of perfection the economy, closeness of regulation, durability and simplicity which are essential to a steam engine of the first class. For the information of the readers of the REVIEW, we are able to present this brief description: This engine, now so well and favorably known, was designed by Mr. Edwin Reynolds. In external appearance it is somewhat similar to other engines of the Corliss type, but embodies many improvements, resulting from the long experience of Mr. Reynolds in designing and building engines of high economy. In the design and construction of the bed, in the arrangement of the valve gearing and liberating devices, and in the general proportion and symmetry of its parts, the Reynolds-Corliss steam engine is far in advance of some other automatic cut-off engines. The general appearance of the engine will be best understood from the illustrations. The cylinder is firmly bolted to the bed, and is supported by two heavy legs, which are held to the foundation by heavy bolts. The main pillow block is cast solid with the bed, and has a broad bearing on the foundation. At the center of the bed, under the slides, is another support, which gives additional solidity to the bed, and renders any springing or vibration impossible. All parts of the engine are made exceptionally heavy, and all wearing surfaces have ample proportions and are finely finished. So strongly built and so carefully fitted is this engine that it has been in many instances run at speeds hitherto deemed impossible in engines of the Corliss type; and under the most disadvantageous conditions its durability, economy, effectiveness, and ease of working have been the subject of much favorable comment among expert engineers. The valve gear is so arranged as to be noiseless in operation, and to give a sharp cut-off and instantaneous closure of the ports.

The following points are peculiar to the Reynolds-Corliss engine:

First.—It is durable, simple and reliable, with all the working parts in sight and accessible for adjustment while the engine is in motion.

Second.—It is heavier and stronger in its essential parts than any other engine, insuring rigidity and smoothness of action not before attained, especially if the engine drives under.

Third.—By the peculiar and simple construction of the valve mechanism the engine can be run at any desired speed, the valves opening with perfect regularity and smoothness, and closing instantly on release of the hook. This is of great importance in flouring mills, as it enables the line shaft to be coupled direct to engine shaft, thus avoiding the use of expensive counter-gearing.

Fourth.—The valves are of such construction that they have double the wearing surface ordinarily found, entirely preventing the cutting of seat, which will occur where small wearing surfaces are exposed to heavy pressure. No springs are required on either steam or exhaust valves.

Fifth.—The steel catches used for opening and liberating the steam valves are so constructed and arranged as to give eight wearing faces on each piece, without redressing or tempering.

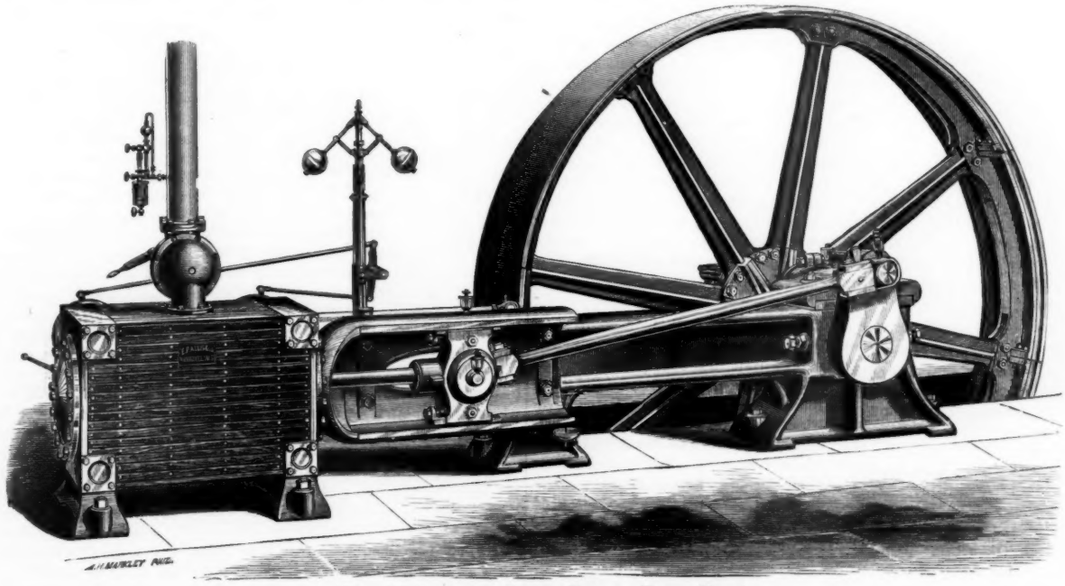
Sixth.—The regulation of the engine is so perfect, that with extreme variations of load and steam pressure, there is not a perceptible variation of speed.

Seventh.—The crosshead has its support on the slides directly opposite the centre of crosshead pin, thus avoiding the springing and final breaking of piston rod, as is often the case where the support is carried back of center of crosshead, as is done in most engines of this type. Any wear on the crosshead gibs or the slides is readily and quickly taken up by the improved adjusting devices peculiar to this engine. The crank-pin, piston rod and crosshead pin are made of steel.

Eighth.—By unhooking the eccentric rod all the valves can be worked by hand, leaving the engine in any required position, and avoiding all pinching over of fly-wheel to get engine off centre.

Ninth.—The condensing apparatus is of new and simple construction, insuring the most perfect vacuum with the least expenditure of power, and cost of repairs. A force pump is combined with the feed-water heater and condenser in such a manner as to insure the highest temperature of feed-water to boiler without the use of any auxiliary pump or injector.

It will be readily recognized that there are many points of excellence in these engines, and we are not surprised to find them so early in the electrical field, competing for a share of the valuable patronage to be found there.



26″ x 48″ REYNOLDS' CORLISS ENGINE—FRONT VIEW.

## An Electric Punt for Sportsmen.

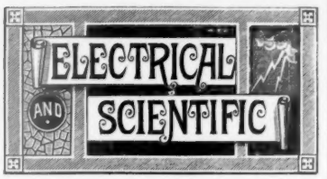
Following up the introduction of Clark's electric launches in England, which have now been some months in use, we now have gunning punts fitted up with an electric motor and battery. Our contemporary the London *Times*, says: the first boat of this description was built to the order of Mr. John J. Mackie, of Auchencairn, Castle Douglas, principally for wild duck shooting, and also to be carried for use in the Norwegian fiords and inlets.

A trial of this boat at Auchencairn proved very satisfactory, a speed of four knots per hour being obtained, while the machinery was noiseless in its action. The punt is 23 feet long by 4 feet 6 inches beam, draws 9 inches of water aft, and carries a very powerful gun weighing about three hundredweight. The propeller, which is two-bladed gives 500 revolutions per minute when both batteries are in use, and with only one battery a speed of three knot sper hour can be obtained.

## The Electro-Chemical Energy of Light.

M. Griveaux has been making some researches on this subject. Instead of measuring the current developed, he measures the electromotive force. The London *Electrician* says that he makes use of Clark's potentio-meter method, and employs as a battery for comparison the Latimer Clark standard cell, this being placed in an open circuit, as the battery formed by plates of sensitized silver, immersed in acidulated water. The battery employed in the closed circuit is a Daniell. The three batteries are surrounded by melting ice, to prevent the disturbances arising from variations in temperature. A Lippmann electro-meter, placed in the circuit of the photo-chemical battery, serves for the measurements; a Ruhmkorff galvanometer in the circuit of the Clark cell enables the apparatus to be more readily regulated. The two resistances—the relation between which should give the relation required between the electro-motive forces—are obtained by two Pouillet rheostats, having identical platinum wires. The rheostat in the circuit of the Daniell battery, and which should give the arbitrary resistance, has a scale graduated in centimetres. That in the circuit of the silver battery has a scale, divided into millimetres, along which slides a vernier for marking tenths, which carries a cup full of mercury, into which the wire passes. The plates are of pure silver. To obtain a deposit of silver salt on their surface of constant thickness, great precautions have been taken. The plates are immersed as positive electrodes in a solution of one-tenth of bromide or iodide of potassium; they are kept always at the same distance from the negative electrode, made of a platinum plate of equal surface. The current is furnished by a Daniell cell, charged with a saturated solution of sulphate of copper and an equally saturated solution of sulphate of zinc; these solutions are always filtered before using. The battery is not mounted until the moment it is required, and the liquids in it are renewed, as well as the solution of iodide or bromide of potassium in the trough and at each new operation. The battery and trough are placed in the melting ice. The wires which connect the silver plates to the battery poles are thick and short, and their resistance may be neglected by comparison with that of the liquids in the trough and of the battery. Owing to the precautions taken, it is admissible that the circuit traversed by the current always offers the same resistance, whilst the E. M. F. of the battery does not vary. The current also does not vary, and, by allowing it to flow for similar lengths of time, the same deposit of salt of silver is obtained. M. Griveaux announces that he has set himself to solve the following questions:—Given the same plate, and the same luminous source, what influence does the distance between them exert? The comparison of different sources to ascertain their luminous power and electro-chemical energy? What influence does the superficial area of the sensitized plate exert, and what is the thickness of the deposit of silver salt? What effects are produced by the same quantity of light falling on plates of different area, but of identical formation? The influence exerted by the character of the light, and, lastly, the relation between the electromotive force developed, and the length of wave of the simple light employed? M. Griveaux promises to communicate the results to the French Academy of Sciences when his observations are completed.

The Finney Electric Light Company, of Pittsburgh, has been chartered, with a capital of $25,000. The new corporation is formed for the purpose of taking and holding patents for the manufacture and sale of electric lighting and telegraphic machinery, and devices relating thereto, and for telegraphic and other devices. The directors are: Charles C. Fitzhugh, John W. Chalfant, W. A. McIntosh, Allegheny; Albert H. Childs, J. R. Finney, David F. Henry, Pittsburgh; Frank Rahm, Philadelphia.




The dividend reports of the Electric Light Companies make an interesting showing for the year past.

"Overcome by Gas" is the headline on a daily paper. We knew those tremendous gas bills would kill somebody sooner or later.

The United States Electric Light Company, of Biddeford, Me., have just declared a dividend of five per cent.

CHEEKY PASSENGER—"Any fear of my disturbing the magnetic currents, captain, by going near the compass?" CAPTAIN—"Oh, no, sir; brass has no effect on it whatever, sir!"

Mr. Robert Hammond, of London, has in the press a work entitled "The Electric Light in Our Homes," in which house-to-house electric lighting from commercial and domestic standpoints is dealt with. The publishers are Messrs. F. Warne & Co., London.

Our esteemed contemporary, the New York *Electrician*, has been enlarged, and under its new name and management is very much improved. Mr. Ralph W. Pope, associate editor, has the principal charge of the business and editorial columns.

The Commissioners of the Fisheries Exhibition have awarded Mr. Charles Lever, of Bowdon, Manchester, a diploma of honor for special services rendered by him in connection with the lighting of the council chamber, lecture theatre, picture gallery, and dining rooms by means of his "Lever arc lamp."

The annual meeting of the stockholders of the Ampère Co. will be held at the office of the company, No. 234 Broadway, Rooms 25 and 26, on Tuesday, February 5, 1884, at 2 o'clock P. M.

The Edinburgh Castle Mission Hall, Scotland, at Limehouse, has been fitted with the electric light by Messrs. Siemens Brothers. There are five arc lamps and 200 Swan lamps, the dynamo feeding the former being of the type S D 8, and that serving the latter S D 0. There are also thirty incandescence lamps in the vestries, &c., fed from a separate machine, the whole being driven by a compound semi-portable Garrett engine.

During the year 1883, Messrs. Siemens Brothers fitted, or commenced to fit, the electric light in twenty steamships, among which were the Arizona (Guion), the Servia and Aurania (Cunard), the Normandie (Campagnie Transatlantique), the City of Rome (Anchor), the City of Chicago (Inman), the Austral (Orient), the Vancouver (Dominion), the Germanic (White Star), and the Massilia (P. and O.). The total number of lamps was over 4,000, or more than 200 per vessel on the average.

The Toronto Electric Light Co., Limited, with an authorized capital of $200,000, have been reorganized with the following officers: E. S. Cox, President; John T. Beckwith, Vice President; Robert Myles, Secretary and Treasurer; S. Hamburger, Manager; who, together with Dr. S. R. Beckwith, of New York, and T. F. Worts, constitute the Board of Directors.

The Olmstead Electric Light Co. has its general office at 79 John street, this city. The officers are Michael Chauncey, President; Aaron Brinkerhoff, Vice President; A. W. Lewes, Secretary and Treasurer; Joseph Olmsted, Electrician; H. S. Belmont, Assistant Electrician. The factory is at Wythe Avenue and Hewes street, Brooklyn. It is said the company will exhibit a six-arc light installation at their offices in a few days, and are now making 6, 10, 16 and 20-light machines.

### A New Company in Illinois.

The following company filed articles of incorporation at the office of the Secretary of State on the 14th inst: The Locomotive, Telephone & Electric Railway Signal Company, at Chicago; capital $2,000,000; incorporators, Gustav A. Wooley, Thos. A. Woodason, and Fred. H. Binder.

At the last meeting of the Chicago City Council, the committee on fire and water agreed to recommend the passage of an ordinance submitted some time since by the Western Edison Light Company, authorizing them to lay conduits and wires underground in the streets and alleys of the city, provided the ordinance met with the approval of the law department.

The work, if done, will be performed under the direction of the department of public works.

### The Micrometer.

A "standard" micrometer has been made for the American Society of Microscopists by the United States Bureau of Weights and Measures. The scale is engraved on platiniridium, 20 per cent. iridium. The examination as to the correctness of this standard was carried on through seven months of last year by Prof. Wm. A. Rogers, of Harvard College Observatory, and it has now been accepted by the society. It is to be kept in approved safe deposit vaults, and not to pass out of the hands of custodian except with the permission of the committee, president and secretary of the society, but other micrometers will be compared with the standard, and the result certified to, for a reasonable fee.

In Europe the electric light seems to be settling down to steady business. Milan is lighting its tramcars with it, and there is talk of its employment on some of the tramway lines in London. Nearly all the great English railways are going to use it in their carriages. Mr. Alfred de Rothschild lights his brougham with it. Mr. Swan, of Swan & Edgar, uses it all over his residence at Bromley, and several private residences in the West End are illuminated from cellar to garret by movable lamps, which are placed amid flowers, in epergnes, on the table, and even attached to the heads of some of the beds for those who desire to burn the midnight carbon.

### An Electric Sounding Lead.

M. E. de la Croix has devised a new sounding lead which has several points of interest. *Engineering* says it tells the exact moment of the arrival on the bottom by means of an electric alarm bell. The sounding line is in reality a cable containing two wires forming the circuit of the bell. It is attached to the ring of the lead at one end, and the hauling winch on board ship at the other. The lead consists of two parts, the lower being hung from the upper by four stems which slide in mortise grooves cut in the sides of the upper part. Its bottom is fitted with the usual hole, armed with tallow to catch a specimen of the bottom. The upper part of the lead, which hangs from the line by the aforesaid hook, is a mass of lead to give due weight, but there is a hollow through its interior containing an electric contact terminating the ends of the two conductors of the cable. This contact, which is of a spring kind, is closed by a stem or plunger attached to the lower movable part of the lead. When the lead strikes the bottom the plunger is driven up a hollow in the upper lead, and makes contact between the ends of the two conductors, thereby completing the circuit of the bell, which rings on board and announces that the bottom has been reached.

### An Underground Company in Trouble.

On January 22d judgments were entered and executions issued against the Goebel Electric Pneumatic Underground Delivery Company by March & Co., and Alexander H. Titus, Jr. The former are creditors for a large quantity of iron pipes and tubing, while Mr. Titus, who got in ahead with his execution, is a director of the company, and holds a confessed judgment for some $720, representing money advanced. The company is said to be within ten days of an exhibition at Broad and Spring Garden streets.

### Elaborate Electrical Tests in Hoboken.

A jury consisting of President Morton, of Stevens Institute, Hoboken, Prof. Brackett, of Princeton College, Prof. Thompson, of the University of Missouri, Mr. Colman Sellers, of Philadelphia, and Prof. Denton, of Stevens, appointed at the Chicago Exhibition, are engaged at Stevens Institute in a series of elaborate tests of the machinery and apparatus and lamps of the U. S. Electric Lighting Co. A very expensive plant has been put up in the College workshops and in the physical laboratory. Two dynamometers, weighing two tons each, one of them swinging on knife blades in Prof. Brackett's rocking cradle for the purpose of testing the horse-power consumed in producing the electric current, are among the larger pieces of mechanism used in these tests. The largest tangent galvanometer ever constructed is also in use, for testing the strength of the current. The two hundred incandescent and forty arc lamps are employed. Associated with the gentlemen already named is Dr. William E. Geyer, Professor of Applied Electricity, of Stevens.

Dr. Austin Meldon, of Dublin, has invented an electro-motor, which is said to create the largest amount of driving power with the least expenditure of electrical energy. The armature is formed by joining together two fifteen-inch solid pulley wheels with seven flat bars of iron, each bar being 24 inches long by 3 inches wide and 1.5 inches thick, and the bars are laid upon gutta-percha, copper bolts being used to fasten them to the wheels. A shaft of 1.4-inch steel passes through the center, and the whole is supported by a hard-wood frame stayed with iron. Each side of the frame where the shaft emerges therefrom is supplied with an ivory commutator, the one on the right having three and the other four brushes, each of which communicates with a magnet. Attached to the frame are seven electro-magnets, the three larger ones being made of 2-inch soft iron, and wound with No 14 wire without bobbins, and the other four of 1.5-inch iron and wound with No. 11 wire. The total weight is a little over three hundred weight.

Some physical results of the Java disturbances help us to understand how small the world is. Take a bowl of water, agitate the fluid in the center, and the undulations you excite propagate themselves in smooth-swelling concentric rings till they lap against the sides of the bowl. There they break and slop up in mimic tidal waves. This is a exact illustration—*magna componere parvis*—of the oscillations of the sea reported from both hemispheres recently. The tidal irregularities, as might be expected, were most violent on the northwestern seaboard of Australia, which lies right opposite the scene of the Java disturbances. On that coast the sea retreated and advanced a hundred yards. A day or two later oscillations appeared on the Atlantic seaboard of America. The particular undulation which, on the fifth day out, slopped up on the east coast of New Zealand must have come by way of Cape of Good Hope and Cape Horn, and had nearly completed the circuit of the globe. Australia lies as a breakwater between us and Java by the direct route. It gives one a new conception of the littleness of what Henry Ward Beecher calls "this fi'penny-ha'penny world," when a man can stand on the Ocean Beach at Dunedin and watch the ripples from a splash made in the Straits of Sunda.

### Annual Convention of the Brush Electric Association.

The first annual convention of this Association, organized at Cincinnati a year ago, was held at the Kennard House, Cleveland, Ohio, on January 23d. The following delegates were present: M. C. Bullock, of Chicago, A. J. DeCamp, of Philadelphia; H. H. McGrath, of New York; G. A. Redman, of Rochester; G. S. Erb, of Salt Lake City; J. E. Ridall, of Pittsburgh; J. W. Post, of Toledo; F. P. Baker, of Topeka, Ks.; Hugh A. Hamilton and John D. Milburn, of Memphis, Tenn.; G. R. Montague, of La Crosse, Wis.; J. R. Johnson, of Rock Island, Ill.; C. H. Long, of Middleton, O.; C. C. Curtiss, of Cleveland, representing the Indianapolis Company; R. H. Wright, W. B. Raymond, H Schumacher, and Dr. George D. Baker, of Akron.

The session lasted all day. No business of public interest was transacted, the time being occupied largely in reports of various members as to the work of the past year, which has shown a very remarkable growth of the electric lighting all over the world. In the afternoon the delegates were taken out to the works of the Brush Company, in this city, the guests of Mr. Charles Brush, who escorted them through his laboratory and other departments of the institution. The following officers were elected for the ensuing year: President, M. C. Bullock, Chicago; first vice president, J. B. Baker, Topeka, Ks.; second vice president, J. R. Johnson, Rock Island, Ill.; secretary and treasurer, J. E. Ridall, Pittsburgh, Pa; executive committee, M. C. Bullock, F. P. Baker, J. R. Johnson, J. E. Ridall, and A. J. De Camp. The officers were all re-elected with the exception of Second Vice President Johnson, who succeeded S. H. Bell, of Nashville, Tenn. The place and time of the next convention was left to the decision of the executive committee.

In the discussion of new methods of insulating wires, M. Wiedemann recently gave an account in *Comptes Rendus* of a method of insulating metallic conductors. The REVIEW gave a short account of this some time since, but we have since gathered some additional facts concerning it. He says "that having had occasion to employ the methods of Nobili and Becquerel in the decoration of objects of art, he observed that the parts so colored became absolute non-conductors of the galvanic current when the process was completed of covering their surfaces in this way with peroxide of lead or of iron. A wire of copper or brass, or even of iron, can in this way be coated with an insulating surface, and the inventor thinks that in telegraphy and telephony an application of this process may be very useful. The process is simple and the cost small, and the power of the insulating surface to withstand the effects of atmospheric action is a guarantee of its durability. The insulation is, moreover, absolute. The following is the process: Prepare a bath of plumbate of potash by dissolving 10 grams of litharge in a liter of water, to which 200 grams of caustic potash are added, and boil the mixture for about half an hour. Allow the liquor to stand, then decant, and the bath is ready for use. Fix to the positive wire the metal wire destined to receive the peroxide of lead, and place in the bath a small anode of platinum attached to the negative wire. Highly divided particles of lead will precipitate themselves on the negative pole, while peroxide of lead forms on the metallic wire, which passes successively through all the colors of the spectrum. The insulation is not perfect until the wire reaches its last tint, which is a black-brown. The wire so covered is perfectly insensible to electric current. Small clean objects attached to the surface can be brought to the negative pole of a gilding, silvering or nickeling bath without any deposit taking place upon them. Such a wire placed in the current, and brought into contact with another wire in connection with a galvanometer, leaves this perfectly unmoved. There is no deviation at all from the current flowing through the wire. M. Wiedemann thinks that such a method will be highly advantageous to the construction of galvanometer coils and other instruments."

## TELEGRAPHIC

The International Telegraph Company is being formed at Toronto.

Robert Stewart, Acting General Manager of the Baltimore and Ohio Telegraph Company resigned on the 26th inst.

An agreement has just been signed by the Hellenic Government and the Eastern Telegraph Company, for the laying of new cables between Greece and other countries.

### The Telephone in New South Wales.

Telephone communication has now been completed between Maitland and Morpeth. The offices of the Steam Navigation Company are now connected with several commercial houses in West Maitland.

### Salaries Advanced.

The Police Commissioners of New York, on the 24th instant, increased the salaries of the telegraph operators at Police Headquarters from $1,100 to $1,200 a year, and the salary of the superintendent of telegraph from $2,300 to $2,500.

### The Telegraph Service Revenue in Great Britain.

The receipts of the telegraph service in England from April 1st, 1883, to January 5th, 1884, were £1,355,000, against £1,315,000 in the corresponding period of the previous year.

### Promotion.

Mr. G. T. Williams, of Cleveland, Ohio, Telegraph Superintendent of the Nickel Plate Railroad Company, has been appointed General Manager of the National Telegraph Company, which will operate the lines of the Nickel Plate, West Shore, and some lateral branches. The company will soon be ready for business.

The Bankers' and Merchants' system of telegraph companies has engaged Mr. R. S. Guernsey in its Law Department, which has been lately organized. It will be remembered that Mr. Guernsey held for some years a responsible position in the law department of the Western Union, and after that time was in the law department of the M. U. Tel. Co.

### Transfer of Telegraph Franchise.

WASHINGTON.—In reply to a resolution asking about telegraph companies which have received subsidies in bonds and lands, and have transferred their rights to other companies, the Secretary of the Interior has instructed the Railroad Commissioner to call on subsidized railroad companies for information, and, in case any such transfer has been made, to furnish him with its terms.

### The Merchants' Telegraph Co.

Articles of association of the Merchants' Telegraph and Cable Company, were filed 29th inst. in the County Clerk's office. The lines of the company are to start from this city, to Sandy Hook, to the city of Brooklyn, thence to the south shore of Long Island, thence under and across the Atlantic Ocean to the coast of Great Britain, and also to the coasts of France and Germany. The capital stock of the company is fixed at $13,000,000 divided into 1,300 shares of $1,000 each. Provision is made for an increase of the capital stock to a sum not to exceed $20,000,000. The corporators of the company are Thomas L. James, Anderson Fowler, Matthew C. D. Borden, Edward A. Quintard, David Bingham, William A. Cole, Edwin R. Levermore, Henry W. O. Edye, John H. Hebert, John F. Plummer, Edward H. Tobey, and Vernon H. Brown, each of whom holds ten shares of the stock of the company.

### No Coalition with Old Companies.

Mr. Mackey has written a letter to the *Times* on behalf of the Commercial Cable Company, stating that when the company's two cables are completed they have no intention of entering into any agreement or coalition with existing companies.

In Chicago, the city was enjoined, some time since, from interfering with telegraph wires and poles, but the authorities do not propose to interpret the injunction as destroying all their control over the telegraph companies in such matters. At the next meeting of the council an order will be submitted forbidding the changing of all wires and poles, without the consent of the city electrician, and also the stringing of new wires.

A resolution of inquiry into the methods of the Western Union Telegraph Company in conducting its transactions with individuals and corporations was prepared for introduction into Congress one day last week, but has not yet been brought forward. Mr. Hill, who was spoken of as intending to offer it, says it will not come from him, but will go to the Committee on Post Offices and Post Roads, of which he is Chairman, if it is introduced. The committee will listen one day this week to an argument by Dr. Norvin Green against the bills to establish postal telegraphs.

### A New Telegraph Company.

NORRISTOWN, N. J.—A charter has been applied for before Governor Pattison, by Charles T. Cresswell, Albert T. Guilbert, Severo Mallet Provost, Henry Cummins, and Theodore B. Armstrong, for an intended corporation, to be called the postal Telegraph and Cable Company, No. 1, its object being to construct, maintain, and operate lines of telegraph, commencing in Bucks county, at a point on the Delaware river, near Lumberville, and running thence through Bucks, Montgomery, Delaware, Chester, Lancaster, and York counties to a point on the line between Pennsylvania and Maryland, near Slate Hill, York county.

### The New Cable Company.

*Money*, of London, in its issue of January 9, says of the American, British, and Continental Cable Company: "Since our last notice, on the 12th ult., of this projected scheme, negotiations have been pending for the acquisition, in both hemispheres, of extended telegraphic rights, supplementary to those which had been already obtained. These additional concessions put the company into possession of a system unequalled, in magnitude and importance, in submarine enterprise. Fresh guarantees of powerful financial support are being daily received, and the company will appear before the public with its share list largely underwritten. Within the past week the necessary contracts for the construction and laying of the cables have been entered into."

### Recent Court Decisions.

TELEGRAMS NOT CONFIDENTIAL COMMUNICATIONS.

CHICAGO, Jan. 23.—During the trial of James H. Melville for alleged embezzlement, in the Criminal Court, before Judge Hawes, yesterday, the prosecution desired to prove that part of the money was sent to Melville through the Western Union Telegraph Company. The money-order clerk of the telegraph company declined to produce the message on the ground that messages could not be made public property. The court ruled that telegraph communications could not be considered more confidential than any others, and that no communication could be excluded when the cause of justice renders its production necessary. The company then produced the message.

### Insufficient Cable Communication.

The three submarine cables, connecting Marseilles with Algeria have become insufficient, on account of the accumulation of the communications. In order to increase the capacity of those cables, the manager of the central office at Marseilles has proposed to the Minister of the Posts and Telegraphs, to substitute, in the place of the ordinary transmission by hand, a mechanical transmission, based on the adaptation of the Wheatstone system, which has been used for a long time on the elevated lines, with siphon recorder.

Some new experiments were made recently between France and Algeria, and success has confirmed the first essays. The rendering has been carried to 48 words per minute, or 90 instead of 30 dispatches per hour, in a middle way. That new improvement will have for result the lowering, to one cent per word, the rate of the telegraphic communications between the metropolis and Algeria.

### The Telegraph in the German Empire.

At the end of 1882 the length of the telegraph lines in the German Empire was 63,284 kilometers, of which 5,471 kilometers were underground, against 61,656 kilometers a year ago. The length of wire was 222,101 kilometers, of which 37,421 were underground. 3,178 officials form the staff The total number of instruments in use is 11,518, against 11,072 in the previous year. There were 129,379 poles, 899,135 telegraph poles, 2,848,062 insulators. The number of telegrams forwarded shows an increase of 811,-75, or 5.22 per cent., their number having risen from 15,535,883 to 16,347,058. Most telegraphic messages were sent to Au-tria-Hungary (472,903) and Great Britain (325,-962). The number of words of inland telegrams was as follows, during the year 1882: ) per cent. of the messages had 5 words, 45 per cent. had 6 to 10 words, 27 per cent. had 11 to 15 words, 11 per cent. had 16 to 20 words, 3 per cent. had 21 to 25 words, 2 per cent. 26 to 30 words, and 3 per cent. over 30 words. The average length of inland telegrams in 1882 was 11.60 words, as against 11.90 in 1881.

### Statistics of the German Post Office.

The statistics for the year 1882 of the "Deutsche Reichs-Post und Telegraph-enverwaltung" have now been published. The following figures, which we extract from these statistics, will be of interest: The area over which the German service extends is 444,399 square kilometers, with 37,978,165 inhabitants. This makes 85 inhabitants per square kilometer. The number of German post-offices in 1882 was 10,582, which shows an increase of 1,437 for the year. There were 6,167 telegraph offices (an increase of 271 for the year), 51,414 letter boxes (an increase of 1,822), 70,597 officials (an increase of 3,522). 1,526,241,996 letters, post-cards, patterns, and parcels were forwarded during the year (an increase of 84,441,714). The total value of money transmitted by post was 15,623,723,414 marks (an increase of 922,177,-354 marks). The total weight of parcels forwarded per post was during the year 301,354,-290 kilog. (an increase of 18,481,020). The total receipts in the year 1882–3 were 151,453,-855 marks (an increase of 5,593,112 marks), the total expenditure 130,116,653 marks. There was, therefore, a profit in the department of 21,337,202 marks, against 21,206,207 marks in 1881–2. The salaries paid to officials in 1882–3 was 71,000,000 marks. 934,135,032 postage-stamps were used, against 887,325,700 in the preceding year.

### Activity of the Bankers' and Merchants Telegraph Company in Pennsylvania.

The Bankers' and Merchants' Telegraph Company have distributed many poles along the public road east of Norristown, a distance of about five miles, and the work of planting them and stringing of wires will be commenced at once. When completed, the wires purchased from the Lehigh Telegraph Company will be connected. J. M. Bertolette, manager in this city, has been retained by the new company, and will be given an assistant about the 1st of February. A large quantity of battery material and other supplies have been received in Reading. The main battery is to be used for through lines to New York, Philadelphia and Washington. Mr. Maxwell, the superintendent of the Bankers' and Merchants' lines, was at one time the manager of the U. S. Telegraph Co.'s office. A large gang of men have been engaged all winter in erecting poles and stringing wires through the lower part of Montgomery and Chester counties, a portion of which is now located in West Chester. It is an unusual thing for telegraph companies to build lines during a severe winter, but the company seems determined to make as much headway as possible, and is busy at work now.

The postal telegraph scheme of Senator Edmunds involves some serious dilemmas. Senator Edmunds asserts that the Government has the same power to establish a postal telegraph system that it has to establish the Post-Office Department. But it does not follow that what may be constitutional is equitable or expedient. If a Government telegraph monopoly is managed with care, and if the rates are put so low that private companies cannot successfully compete with them, the practical effect is a sweeping confiscation of the private property invested in telegraph operations. Government could not more effectually confiscate the private property so invested if it seized all the lines of telegraph, and converted them without compensation to its own use. A monopoly so established may be entirely within the bounds of the constitution, but the question for an equitable Government is whether it is just towards the citizens who have in good faith invested their capital in telegraph enterprises.

If, on the other hand, this proposed postal telegraph is not to be a complete Government monopoly, it will entail upon the people an enormous expense without compensating benefits. The Post-office Department is successful because it is a Government monopoly with which all private competition is forbidden. Upon the same condition only can the postal telegraph be made successful. If the rates for dispatches are such as to allow private competition, the private companies will enjoy the cream of the business, and the Government establishment will entail on the people an immense and comparatively useless burden. The rates of dispatches by the Government telegraph between Boston and Portland, Oregon, might be fixed so low that private companies could not compete with them, which would be satisfactory, no doubt, to the small number of people who might avail themselves of the public establishment. In the meantime, the private companies would be able to successfully compete with the lowest rates of Government on the short lines between populous centers of trade. The result of this sort of competition would be realized by the taxpayers in an enormous deficit at the end of the annual account.

A prominent official of the Bankers and Merchants' was in Baltimore on the 29th inst. He said that within thirty days the Bankers and Merchants' would be in Chicago, where a connection would be made with the Pacific Union, the new company formed by the consolidation of the several Pacific railway telegraph systems. This would give through connections from the Atlantic coast to the Pacific, in opposition to the Western Union. The official thought the country was on the eve of one of the most exciting telegraphic wars ever seen in the United States. He said he understood the Postal Company was trying to sell out. They had been negotiating for over a week past, but he refused to say with what company the negotiations were being carried on.

The Bankers and Merchants' Telegraph Company has secured the control of the United States Telephone Company, and proposes to go actively into the telephone service. The United States Telephone Company owns the McDonough patents.

## Telephonic News

The Southern New England Telephone Company has declared a quarterly dividend of 2½ per cent.

The new coal-hardened copper wire line of the American Bell Telephone Company is finished as far as Westerly, R. I.

Interesting experiments have lately been made by MM. de Branville at Paris, with a new phonic call apparatus, which allows the telephonic calls to be heard distinctly in an adjoining room.

On Friday, February 1st, the annual meeting of the stockholders of the New York and New Jersey Telephone Company will be held at the offices of the company in Brooklyn, N. Y.

The new directory of the city of Frankfort-on-the-Maine contains the name of every subscriber of the telephone exchange, and is marked with a small telephone, and a list of the subscribers, with their numbers, is added.

We are looking now for the proper name for a telephone message. "Hellogram" has been suggested, but from the frequency with which we hear "Hey!" from the other end or the line, we think it could be shortened to "Heygram."—*Oil City Derrick.*

In Rome, a new central office for the telephone has just been opened at the Sciarra palace by the Italian Telephone Society. The residence of the King of Italy, Castle Porziano, has been put in communication with that office.

### Out-put of the Tropical Co.

Since December 1, 1883, the Tropical Telephone Company has sold over 1,000 sets of instruments for use in its territory, 75 sets going to Mexico, 118 sets to the West Indies, 250 sets to the west and east of South America, where Boston parties are developing quite a telephone business, and the balance to Brazil, Venezuela and the Argentine Republic. The instruments are paid for before delivery, and the company assumes no risks. The company receives a stipulated sum on every set sold.

### Government Royalties on Telephones.

WASHINGTON, Jan. 24.—The claim of the American Bell Telephone Company against the Government for payment of a royalty on all telephones manufactured by the United States Signal Service, in use by the Government, as infringements on the Bell patents, was settled to-day, by a contract whereby the Government pays the Bell Company the royalties claimed.

### The Telephone in Holland.

The progress of the telephone in Holland has been very remarkable in the course of the year just elapsed.

The *Nederlandsche Bell Telephoon Maatschappij*, the company having charge of working the telephones in that country, reckons this day 1,972 subscribers for 4,160,580 inhabitants, or one subscriber for 2,109 inhabitants. The city of Amsterdam alone has 1,049 subscribers, or one subscriber per 315 inhabitants. It is the largest proportion, we believe, to be found all over Europe.

### Religious Doctrine and Music by Telephone.

After last summer's vacation a small metal grating was discovered in the east wall of Grace Episcopal Church, Harlem, just above the heads of the choir.

"It's a telephone," said the sexton last night, as he saw a churchman gazing at it curiously. "It was put there last summer by the tenant in the adjoining house, who, by the way, is a Baptist. She had masons cut through the two-foot wall, when the church was closed, and now when she wants the benefit of a religious service, but don't feel like attending her own church, she sits in her parlor, holds the telephone receiver to her ear, and hears everything as perfectly as if she were right under the choir or the pulpit."

### The Bombay Telephone Company.

The first ordinary general meeting of the Bombay Telephone Company was held on December 12, in London, the Hon. W. M. Macaulay presiding. The chairman, in moving the adoption of the director's report for the past year, said that most of the shareholders appeared to have run away with the idea that the company would not be a success, because the first year's working had resulted in a loss. Some of them were also apparently dismayed by the opposition threatened by a rival company; but the chairman was firmly persuaded that the Crossley Telephone Company was powerless to do the slightest injury to them. The Bombay Telephone Company had been doing a very good business of late, and the chairman had no doubt that their financial condition would before long undergo considerable improvement. The shareholders considered the chairman's statement to be quite satisfactory, and unanimously adopted the report which was submitted to them.

### The Telephone and the Press.

The *Bolton Evening News* and *Bolton Weekly Journal*, the *Farnworth Journal and Observer*, the *Pendlebury and Swinton Journal*, the *Eccles and Patricroft Journal*, the *Leigh Journal and Times*, the *Tyldesley Journal*, newspapers and reviews, which are published in England, in Lancaster county, are now all connected with each other by telephone. They use the Bell telephone and Blake's transmitter. Conversations are easily exchanged between the offices of those papers at Bolton, Farnworth, Pendlebury, Eccles, Leigh, Tyldesley; the circuit has a total length of 23 miles. The wires have been placed, and the instruments and apparatuses installed in the sundry, the editorial, and administrative offices, by the Lancaster and Cheshire Telephonic Exchange Company.

### Humors of the Telephone.

Some of those whose telephones were put out of order by the extra dose of electricity tell interviewing reporters that it was a blessed relief. One railroad official says:

About once in two or three rings, I get something like this:

"Hello, George, dear!"

"Well, hello!"

"Baby just said 'goo, goo,' four times, and I know he wants you to come home to supper."

"Baby? Who in thunder do you think I am?"

"Aren't you No. 11,701?"

"Certainly not. Good day."

Now, you see, this is an interruption to business.

### Annual Meeting.

On Thursday last the stockholders of the Iowa Union Telephone and Telegraph Company held their annual meeting, and elected the following directors: James Thompson, Geo. W. Cable, E. S. Carl, F. H. Griggs, Anthony Burdick, E. A. Benson, W. H. Decker, W. A. Leary, H. H. Matlock.

The directors presented a report of the work for the past year, which was very satisfactory to the stockholders; the indication showing that there was a very large inquiry for lines throughout the State, and that the increase in dividends would depend wholly upon the development of the territory. The report, as a whole, gave good satisfaction to the stockholders.

In the afternoon of the same day the new directors met, and the following officers were elected: James Thompson, President; W. H. Decker, Vice-President; A. F. Cutter, Secretary; E. S. Carl, Treasurer; W. A. Leary, General Manager.

The following were appointed an Executive Committee: F. H. Griggs (to be chairman of said committee), W. H. Decker, James Thompson, W. A. Leary, H. H. Matlock.

### Dividends on Telephone Stock.

The Lowell *Mail* gives these interesting facts touching the dividends of some of the subordinate companies. The Erie Company pays its second quarterly dividend to-day, amounting to $48,000. This amount is distributed among 1150 stockholders, 380 of whom are in Lowell, and own 24,535 shares of the 48,000 shares issued. Of this number of shares it is reported the syndicate hold 10,000. The Union Company pays its fifth quarterly dividend of $1,500 to 115 stockholders, 25 of whom are in Lowell, and hold 514 shares of the 1,000 shares issued. The New England Company pays its first quarterly dividend to-day, amounting to $71,395, payable to 1,200 stockholders. Of this amount $18,750 goes to Lowell, to be distributed among 375 stockholders, who hold 15,000 shares. This is the nineteenth quarterly dividend those shareholders will have received who were stockholders in the original Lowell District and Maine telephone companies, which form a part of the New England Company. The aggregate of the quarterly dividends in which the Lowell syndicate is interested is $122,895, which is nearly 5 per cent. on $10,000,000 of capital invested.

### Police Telephone Boxes in Columbus.

There was a called meeting of the Board of Police Commissioners at the Mayor's office January 22d, the object of which was to come to a conclusion concerning the putting up of police telephones and boxes. Mr. L. B. Firman, representing the Chicago firm which controls the system, was present, and after discussion was had on the relative cost of twelve or more stations, produced a letter from General Manager Lauderback, offering to put up twenty five boxes and telephones, keep them in repair, and furnish all wire needed for additional boxes, for $3,650. The first proposition had been for twelve boxes at $2,000, without the extras mentioned. Arrangements had been made with the Central Union Telegraph Company to use their poles, but in order to avoid complications or delays it had been decided to string separate wires, the Central to take charge of and keep up the wires.

It was arranged to have the system in operation within ninety days, the contract to be signed by the company and city as soon as the papers can be prepared. Work will begin, it is said, in about a week, and it is thought that not more than six weeks will be required in which to complete the contract.

### Points in the Telephone Controversy.

Judge Lowell, in his decision in the case of the American Bell Telephone Company *vs.* Prof. Dolbear, brought last year to determine the scope of the latter's patent for a telephone, says:

"All the evidence in this case clearly shows that Bell discovered that articulate sounds could be transmitted by undulatory vibrations of electricity, and invented the art or process of transmitting such sounds by means of such vibrations. If that art or process is the only way by which speech can be transmitted by electricity, that fact does not lessen the merit of his invention, or the protection which the law will give to it."

An injunction was granted against the Dolbear telephone, and an appeal taken to the Supreme Court, where the matter is now pending.

"Probably hundreds of different patents have been granted in this and other countries for instruments in use in telegraphy, the sole functions of which are to open and close an electrical current, and thereby produce either telegraphic sounds or characters at the other terminus of a line of wire. The patentees of these instruments made no claim to a new use of the wires in the circuit. That would have been absurd. Neither did they or could they possibly lay claim to the idea of using an electrical current which aided them in conveying from one point to another their telegraphic dots and dashes. What they did patent was the peculiar application of mechanical forces, which, harnessed with electricity, established a form of telegraphic communication.

Prof. Dolbear claims to have patented a telephone materially and essentially different from that invented by Prof. Bell. If he can assert his claim in a manner which will convince the Supreme Court that such is the case, why should he not reap the benefit of his researches in the yet far from developed and exhausted field of electricity? As yet, we must confess, he has not made much progress in that direction. It is said that the professor asks not for the right to use sound, for that would be preposterous. He asks for the right of conveying sounds by a particular method, and to deny him that right, if he has produced something entirely new and novel, would be as unjust as it would to have denied Edison the right to send six telegraphic messages over a single wire at one and the same time, simply because others had prior patents for mechanism by which one, or even two messages could be carried simultaneously, on that one wire."

The large dividends now being paid by the telephone companies throughout the country will tend greatly to advance stocks of these local companies at an early date. The showing is better than in any previous year.

### The Telephone in Western Maryland—The Frederick District.

This section of the State had always been looked upon as hopelessly dead, telephonically, until Mr. E. L. Miller, formerly of the Mutual Union, by his push and energy succeeded in starting an exchange of forty subscribers on June 1st, 1883, under the general managership of John A. Blattan, of the Telephone Exchange Co. The exchange grew slowly until Sept. 1st, when the Chesapeake and Potomac Co. took charge, under the efficient supervision of general manager Mr. H. B. Lytle, of Boston, ably seconded by Mr. Miller, whom he now appointed as superintendent. The exchange grew rapidly. General Manager Lytle had the entire system reconstructed, it having been originally built for only a small local exchange, and wires were run in all directions. Hagerstown, and numbers of smaller points are now in communication with Frederick; and there is only a breach of some ten miles separating Frederick from Baltimore, when work was stopped owing to the bad weather.

The exchange has now nearly 200 subscribers, and is arranged, equipped, and officered as follows: It occupies the entire 4th floor of the Etchison building. The first office is the private office of Supt. Miller; next, the stock room; then the clerk's office; then the operating room; and last, the battery and test room. The operating room has a 200-wire western electric switch, latest pattern, with cables running to the test room; is plainly, yet tastefully, furnished, and is in charge of Misses Bartges and Byrnes as operators day, and Mr. Frank Gittinger, night. The test and battery room are complete. The clerk's office fitted up for the bookkeeper, Miss Frazer; inspector, Mr. F. Rhodes, and collector, Mr. G. H. Morgan. The repair department is in charge of Mr. G. Warner, while the construction is under the man-

agement of Messrs. Geo. P. Lowe and W. S. Taylor. The exchange is in a flourishing condition, and in an interview with Supt. Miller he informed your correspondent that subscribers were coming in rapidly, and that he believed this would be one of the most successful exchanges in the State. I can safely say, after careful inquiry, the general opinion is that the system and service here is perfect; every one loud in their praise of the satisfactory manner in which their business is handled. Mr. Miller is thoroughly a business man, and has made the telephone here an auxiliary to business, instead of a mere convenience or medium of pleasure, and I believe this to be the secret of his success. Both General Manager Lytle, for the plans he has laid out, and Superintendent Miller, for the careful execution of the same, deserve great credit and thanks from this community which they have so greatly benefited.

MUNSON.

### The Fargo (Dakota) Exchange.

This new exchange has grown more rapidly since its opening than any other in the territory.

Seventy-five miles of wire is connected with this exchange, and Superintendent Smith states that it covers more ground than any other exchange having the same number of instruments, and at the same time Fargo has more instruments in proportion to its population than any other city.

One hundred and eighty-eight instruments are now in use, and the tables have a capacity for three hundred. These tables are of improved pattern, and are much handier than the old ones, and better connection can be made from one wire to another. A gong has also been ordered for the central office, and this will be connected with each table, so that at night a subscriber can awake the operator with ease, should he fall asleep.

The change of location, and the improvements in the line, have cost the company about $2,000, and their manager states that they will spare no expense to make the Fargo exchange satisfactory in every respect to the patrons. Six line repairers have been at work for some time on the changes. Three are still here.

The Fargo exchange is in charge of H. D. Smith, as superintendent. He is a young gentleman of pleasing address, and has made hosts of friends since he arrived here to take charge of the work.

### Rapid Progress in the Northwest.

The story of the telephone may be embodied in experiment, adoption, practicability, and an unlimited future. Its advent during the present age has brought workers into its field who commenced with its inception, and have ever since "hustled" to keep apace with its advancement as a practical utility. The business has demanded the best of management and direction to hold its rapid advancement through its early drawbacks and complications, coupled with the newness of the business. Consolidation throughout the country is reducing the business to a system, and the manager who does not claim his exchange to be "*the* finest" is fast becoming a nonentity.

Everything and everybody west of New York—necessary to draw the line somewhere—is on the jump. The day when people came West for their health has gone by. The almighty dollar is the alliterative pie in which every man strives to put his finger.

Independence, and a liberality to further public good, are predominating features. While the telephone holds a gradual and healthy growth in the crowded cities East, the push of business and advent of new enterprises in the rapidly-growing cities of the West demand that business necessities keep apace. Minneapolis and St. Paul, in Minnesota, are the two best advertised cities in the country. Every newspaper reader is conversant with their advantages and remarkable growth. The section of country surrounding affords natural resources for manufacturing, and its lumber, wheat, and grain productions are unbounded.

The telephone was first introduced in the Northwestern country by Mr. C. H. Haskins, of Milwaukee, a pioneer in the telegraph business, and extensively identified with electrical work. Mr. R. H. Hankinson, who was connected with Mr. Haskins in the old "Northwestern Telegraph Company" before the extension of the Western Union Company, became agent under Mr. Haskins for building private telephone lines and leasing instruments for the same throughout Minnesota and Dakota.

Early in 1880 exchanges were started in Minneapolis and St. Paul by the Northwestern Telephone Exchange Company, the number of subscribers being very small. Soon after, license was obtained for establishing exchanges throughout Minnesota and Dakota. Exchanges were opened at Stillwater, Red Wing, Faribault, Winona, and Wabasha, and under sub-leases exchanges started at Fargo, Grand Forks, and Jamestown, Dakota; and at Brainerd, Crookston, and Duluth, in Minnesota. The business grew phenomenally, facilities in the rapidly-growing cities not meeting the demands of the increase in subscribers. Early in March, 1883, the entire property was purchased by the Lowell Syndicate, and steps taken to extend the business in the rapidly-growing cities and in the undeveloped country. At the time of the purchase there were in operation seven exchanges, embracing in exact number 1,268 subscribers.

The first moves of the new management were radical changes in the systems of Minneapolis and St. Paul.

When the changes were commenced, the Minneapolis exchange was operated through old-fashioned switches, requiring too much individual labor from the operators, and of necessity delaying work and giving very poor service. After discussing the merits of the several styles of switchboards, it was decided to introduce the "multiple" board of the Western Electric Company. A thorough reconstruction of city lines was at once commenced, and during August the new system opened. As a result of these changes, the increase of subscribers during August, September, and October reached in the vicinity of 250. Fourteen lines were constructed on new poles along the boulevard connecting Minneapolis and St. Paul, and an average monthly earning of $600 is carried over these lines. During the summer and fall, exchanges were opened at Northfield, Mankato, and St. Cloud, in Minnesota; and at Bismarck and Mandan, in Dakota; likewise acquiring exchanges at Brainerd and Fergus Falls, Minnesota; and at Grand Forks, Fargo, Moorehead, Sioux Falls, Hann, Watertown, Yankton, and Mitchell, Dakota; in all numbering, January 1, twenty-one exchanges, with exactly 2,720 subscribers. Extra territorial lines have been built, connecting over thirty cities and towns in Minnesota, and the building of additional lines is contemplated for the coming spring.

The practical working of the "multiple" board has exceeded the expectations of the local management, and the efficiency of the service derived is attested to by subscribers to the old system and the new patrons.

The operating room at Fargo, D. T., has been removed to a more central location, city lines reconstructed, switchboards of an improved pattern introduced, and the system is on a very substantial footing.

Business in the small towns throughout Dakota is subject to depression during the cold season; but the telephone business has hardly felt the strain, and the coming spring promises well for a good increase.

Throughout this section the outlook is very promising; the large cities have excellent service, and there are many cities where the telephone has not reached.

All kinds of electrical work is "booming" outside of the telephone sphere. Minneapolis boasts of its "tallest electric light mast in the world." A district messenger system is working admirably under the efficient management of Mr. W. B. Palmer, formerly of the Chicago Telephone Company.

The Minnesota Brush Electric Light and Power Company, under the management of Mr. J. S. King, is doing a profitable business. The dynamos are worked by power from the Falls of St. Anthony. Several concerns carry on general electrical work. The number of buildings constantly being erected makes quite a field for this line of work.

The Western Union Telegraph Company during the past season extended its lines extensively, and there are but few points east of the Black Hills country not reached by their lines.

The Black Hills country has a healthy telephone exchange within its confines, of which detail will be given in these columns at an early day.

D.

Our contemporary, the Boston *Herald*, of the 27th inst., publishes the following interesting estimate of the business of the American Bell Telephone Co., which we should judge is mainly correct:

"Bell Telephone again attracted attention to-day, but the trading was tame compared with yesterday. One hundred and sixty was the opening figure, against a close of 167½ last night. It fell to 152, rose to 157, went off again to 150, and closed at 152. Friends of the company are feeling better since particulars were received of the circuit court decision at Philadelphia. They realize that the merits of their cause remain precisely as heretofore, but that the encouragement given to the opposition may make it a little more troublesome to cope with. As to the worth of the property, friends of the company profess to be in no wise disturbed by the activity of rival organizations. They expect to win the pending suits, but, should they fail, they claim that possession of the field will be nine points in their favor; and, as regards competition, the resources of the company are ample to meet it. The following tabular statement, giving the operations of the company in the fiscal year 1882-83, cents omitted, and a close estimate for 1883-84, and a more general one for 1884-85, has been prepared by the banking house of Jackson & Curtis. These gentlemen are believers in the property, but their advance estimates of the business of 1882-83 were so nearly correct that their figures for this year and next are deserving of consideration. They are certainly interesting. The presumption is in this reckoning that the company will continue to enjoy its present monopoly. The figures are as follows:

EARNINGS.

| | 1882-83. | 1883-84. | 1884-85. |
|---|---|---|---|
| Rental of teleph's... | $1,257,054 | $1,660,000 | $2,060,000 |
| Sales of instruments and supplies... ... | 27,633 | .. . | .... |
| Royalties from manufacturers..... | g | | |
| Dividends..... | 262,385 | 350,000 | 600,000 |
| Com. from extra territorial and branch lines..... | 17,073 | 30,000 | 30,000 |
| Com. from telegraph business..... | 10,736 | 15,000 | 15,000 |
| Miscel. earnings..... | 1,146 | .... | .... |
| | $1,576,031 | $2,055,000 | $2,705,000 |

EXPENSES.

| | | | |
|---|---|---|---|
| Operation..... | $144.991 | $166,000 | $166,000 |
| Legal..... | 112,688 | 113,000 | 113,000 |
| Interest and taxes... | 72,350 | 100,000 | 100,000 |
| Depreciation..... | 24,357 | 27,000 | 27,000 |
| Commission to Western Union..... | 246,821 | 332,000 | 412,000 |
| Royalty..... | 1,777 | 1,800 | 1,800 |
| Totals..... | $603,987 | $739,800 | $819,800 |
| Net earnings for the year..... | 972,044 | 1,315,200 | 1,885,200 |
| Deduct for contingencies.... | ..... | | 100,000 |
| Probable net..... | | | $1,785,200 |
| Stock outstanding Jan. 24, 1884..... | | | 8,855,000 |
| Debt 6 per cent. bonds, convertible April 1884... ..... | | | 645,000 |
| Total capital ..... | | | $9,500,000 |
| Cash in treasury..... | | | 500,000 |
| Net earnings year ending March, 1884... | | | 1,815,000 |
| Probable net earnings year ending March 1885 ..... | | | 1,885,000 |

The company is now earning at the rate of about 17 per cent. on its outstanding stock and debt.

Changes in other telephone stocks are slight. Tropical fell off ⅛ to 2⅜ this afternoon, and People's weakened from 14, and sales yesterday, to 11⅛ bid, 12⅛ asked. A correspondent writes: "I notice that the price of Bell telephone continues to decline, owing presumably to the suits now pending. I am an owner of Erie and New England telephone stock in a small way. Can you inform me as well as other interested parties what effect upon the above-named stocks an unfavorable decision for Bell would have? I have always understood it would be for their advantage." It is purely a matter for speculation whether the subordinate companies would be benefited or otherwise by the admission of rival companies to the telephone field, for that is probably what the correspondent means by an unfavorable decision. The rival companies might consolidate, which would not change matters much from the present status. It might result in sharp competition, cheap instruments, and lower rentals. This would probably develop the business and augment receipts. Reasonably conducted competition is wont to benefit both the public and competitors, and probably would do so in this case. Shareholders in subordinate companies have, perhaps, little to fear from the result of pending telephone litigation.

For the benefit of our telephone readers we print in full herewith the Judge's instructions in the case of the American Bell Telephone Company *vs* the Overland Telephone Company, in Philadelphia, on Friday last. It will be seen that no decision was given, but postponed pending decision in the case now before the Court in New York. The companies opposing the Bell in this case are highly elated over the postponement, as it evidently gives them a brief while in which to sell more stock.

CIRCUIT COURT OF THE UNITED STATES.

THE AMERICAN BELL TELEPHONE COMPANY *vs.* THE OVERLAND TELEPHONE COMPANY *et al.* SAME *vs.* THE PENN OVERLAND TELEPHONE COMPANY.

PHILADELPHIA, Friday, Jan. 25, 1884.

MCKENNAN, *Circuit Judge:*

During the progress of the opening argument in this case we learned that a case was pending in New York which had nearly reached the stage for final hearing, and was nearly ready for final hearing, in which the questions proposed for and our decision in this case were involved mainly, especially the defence set up against this motion that was involved in the alleged invention of Daniel Drawbaugh. It occurred to us then that it would perhaps be unwise in the state of proofs—considering the forms of the proofs upon which the discussion here was founded—to pass upon that motion until both parties had an opportunity for a fuller and more satisfactory investigation of the questions involved, upon proofs taken and upon examination and cross-examination in the case in New York, and therefore it was intimated by us—intimated for the consideration of counsel—that it might perhaps be an unnecessary consumption of time to carry on this discusssion to the end, in view of the possible conclusion that the Court might reach when the discussion was ended on the disposition of the motion; we, however, yielded to the wishes of counsel, and have heard a very interesting and a very instructive argument, but our first impressions have only been confirmed.

We think it would be an unwise exercise of our discretion to grant this motion upon the state of proofs before us and in view of the pendency of the case in New York. We have, therefore, concluded to retain the motion, to afford both parties opportunity of bringing—either of the parties here or either of the parties in that case—to bring that case to final hearing in New York, and we will therefore allow a reasonable time to elapse to afford that opportunity for the disposition of that case.

If hereafter it may be thought advisable or necessary to call up this motion, it may be called up; if unreasonable time is allowed to elapse without bringing that case to hearing, the motion may be brought up by either of the parties; but until time is afforded for a full investigation upon the proofs as they stand, which have been brought very near to a close, we do not think it would be wise or proper for us to grant this motion, or to interfere. Therefore the motion will stand for disposition in the future.

The telephone business in Peru and Chili is once more in good hands, and the latest reports are favorable since General Manager Husbands resumed charge of affairs of the new company operating this territory.

# Electrical Review,

FORMERLY REVIEW OF THE

Telegraph and Telephone.

Published Weekly at 23 Park Row,

P. O. BOX 3329.

GEO. WORTHINGTON, Editor. THOS. H. DELANO, Publisher.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

ADVERTISING.

Transient rate, 25c. per line each insertion.

"Business specials," 35c. a line.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

*We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.*

*We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.*

*Those desiring to recommend their goods can do so to any extent in our advertising columns, but we will not publish for pay anything of that nature in our reading columns.*

*Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.*

*The Proprietors do not hold themselves responsible for opinions expressed by their correspondents.*

*No notice is taken of anonymous communications.*

FOREIGN AGENTS OF THIS JOURNAL,

From whom copies of the paper can be procured.

The Montreal News Company, Montreal, Canada.
The Toronto News Company, Toronto, Ontario, Canada.
Wm. Dawson & Sons, London, England.
H. A. Kramer & Sons, Rotterdam, Holland.
Berthold Mendel, Berlin, Germany.
F D. Osborne, Calcutta, East India.
F. Knauff, Moscow, Russia.

NEW YORK, JANUARY 31, 1884.


CONTENTS.


| | PAGE |
|---|---|
| Interesting Features of the Munich Exhibition. | 1, 2 |
| The Improved Reynolds-Corliss Engine | 3 |
| The Electro-Chemical Energy of Light | 3 |
| An Electric Punt for Sportsmen | 3 |
| The Finney Electric Light Company | 3 |
| Electrical and Scientific News | 4 |
| The Toronto Electric Light Company | 4 |
| Elaborate Electrical Tests at Stevens Institute, Hoboken, N. J. | 4 |
| Convention of the Brush Association | 4 |
| Telegraphic News | 5 |
| Merchants' Telegraph Company | 5 |
| New Cable Company, | 5 |
| Statistics, Telegraphic, in Germany | 5 |
| Telephonic News | 6 |
| Government Royalties on Telephones | 6 |
| Dividends | 6 |
| The Telephone in Western Maryland | 6 |
| Telephonic Progress in the Northwest | 7 |
| Estimate of the Bell Telephone Company's Business, 1883-4 | 7 |
| Full Report of the Judges' Decision in the Philadelphia Case | 7 |
| Mr. Drawbaugh and his Friends | 8 |
| Gas the Fuel, Electricity the Light | 8 |
| The Telephone Business in Pennsylvania, New York, and New Jersey | 8, 9 |
| Book Reviews | 9 |
| Baltimore and Ohio Telegraph Extension | 10 |
| Miscellaneous Electrical News | 10 |
| Electrical Patents | 10 |
| Business Notices | 11 |
| Average Telephone Stock Quotations | 11 |
| Average Market Supplies, etc | 11 |


## Mr. Drawbaugh and his Friends.

A corporate organization, known as the "People's Telephone Company"—so-called, perhaps, because the people are disinclined to take much interest or stock in it—is once more thrusting its claims before an indifferent public. This organization, it may be remembered, was enjoined by Judge Blatchford several years ago, on the complaint of the American Bell Telephone Company that its principal stock-in-trade was an infringement on the Bell patents.

This effectually subdued the ardor of the visionary gentlemen behind the "Drawbaugh Telephone Company," so far as actual operation was concerned. But if the court had closed their usefulness in the telephonic field, it had by no means succeeded in closing their mouths. With a persistency which, in a worthier cause—such, for instance, as proclaiming the attractions of a bear garden—would have brought them undying fame, they have never ceased to harp upon the virtues of the "Drawbaugh Telephone Co." To listen to them, one would almost be led to believe that the whole world had been in a conspiracy against their man. Drawbaugh: that what had been attributed to Oersted and Faraday had in reality never been accomplished until the genius of a Drawbaugh came to enlighten what before had been a dull and stupid and thoroughly unscientific world.

It is said that in a certain section of Pennsylvania, where the natives are yet voting for Andrew Jackson for President—the news of his death not having yet arrived—if you suddenly awaken a native from his slumbers, he will jump to his feet and exclaim, "I nominate Andrew Jackson for the position!"

So it is with these ingenious gentlemen who would jump the telephone claim. Touch one of them suddenly from behind as he is walking down the street, and he will inform you with something like precipitation that Daniel Drawbaugh invented the telephone.

The lawyer or the man of affairs, after listening to these gentlemen, would naturally conclude that this person Drawbaugh had obtained a patent prior to Bell, but such is not even claimed by these visionaries. They will openly acknowledge, and if they didn't the files of the Patent Office would show, that Bell's telephone went into public use in April, 1877, and Drawbaugh did not apply for a patent until May, 1880.

Against this rather conclusive proof that they haven't a leg to stand upon, they set up an assertion that Drawbaugh invented the telephone in 1868, but was too ignorant to understand its value, and too poor to patent it if he had not been.

If we were so bold as to hazard an opinion upon the personal characteristics of Mr. Daniel Drawbaugh, however, we should say that his ignorance was by no means so profound as his cunning, for it seems that during the time that his admirers, with a somewhat effusive and far from complimentary candor allege that he was too ignorant and too poor to patent his telephone, he patented several other mechanisms; and, though too illiterate to understand the necessity for a patent for his own telephone, he openly advertised himself as a solicitor of patents in the interest of the general public.

It requires scarcely more than a superficial knowledge of patent law to know that no patent can be legally obtained for any contrivance which has been in public use for two years preceding the date of application. Now, Bell's telephone went into use in April, 1877, and Drawbaugh did not apply for a patent until May, 1880.

No doubt Drawbaugh, with all his alleged ignorance, long since perceived this, and, unless that ignorance is as profound as those who are now seeking to profit by it would have us believe, he has made many, but it seems ineffectual, attempts to quench their unreasonable ardor.

Recently they would seem to have changed their position in regard to the Drawbaugh case from the legal and technical point of view to the romantic, and it must be confessed that they are even more garrulous and tiresome now than they were before. It may be interesting to them to know that Daniel Drawbaugh *was* regarded by his neighbors as a visionary—it may interest them to know that they *are* now regarded as visionaries.

Here is a sample of the clap-trap with which the company already mentioned is now flooding the country:

"His first conception of the electrical transmission of speech dates back probably from 1860 or thereabouts, and it grew into shape in a curious way. He had learned from two or three old school books on philosophy—his entire scientific library—that sound is made up of vibrations of waves or impulses in air and proceeding from the sonorous body, and this notion had become fixed in his mind by the explanations of the teacher of a singing school to which most of the Eberly's Mills people attended. He had also noticed that sound is conveyed along solid bodies much better than in air—and he found that he could hear slight noises from end to end of a partition or a long plank—so that it occurred to him that the vibrations of sound traveled along the body. He knew that electricity could be conducted along a wire for great distances, and the idea finally formed itself in his mind that if he could make the electrical current take up the sound vibrations in some way he might actually telegraph those vibrations, so that they would be reproduced in another distant place. The problem was how thus to affect the current which he could easily get from one of his electrical batteries, and upon this he began experiments. The neighbors ridiculed him, and his wife remonstrated persistently for what they believed to be a mere waste of time."

His wife seems to have been a very sensible woman, and, had he taken her advice, he would not now be loaded down to the gunwales with these ridiculous friends, who go about the country loudly proclaiming his ignorance and their own folly.

## Gas the Fuel, Electricity the Light.

It is not so long ago that many of our contemporaries were insisting that gas would soon be a thing of the past; yet all the time they were prophesying the manufacture of gas has been steadily increasing. On the other hand, the REVIEW has ever maintained that gas would find a broader field in the future than in the past—but not as an illuminant. As a fuel, gas excels, and this fact has now become so clear that works are being put up in various parts of the country for the purpose of supplying a cheap and easily-handled fuel. This is but a fulfillment of the prediction made long ago by the REVIEW, and we are glad to see that some of our contemporaries are coming to look at the matter in the same light.

It is a well-known fact that more candle-power of electric light can be obtained from a dynamo worked by a gas engine than if the same amount of gas was used directly as an illuminant.

In a recent paper before the Institute of Mining Engineers, a writer says, very truly, that it is safe to assert that, in cities generally, the fuel of the future for all domestic, as well as for most manufacturing and metallurgical purposes, will be gaseous fuel. He says that the process of gas manufacture has not yet reached so economical a point as it is likely to attain in the near future, and then he gives good circumstantial evidence that he is not familiar with the more recent processes, in which all that he predicts for the future has already been realized.

Water-gas, than which it is difficult to imagine a more economical fuel, and, barring sewer-gas, a more poisonous illuminant, is now being made as a fuel on a grand scale in Lynn, Mass.

The immense advantages which gas possesses in facility and cheapness of distribution, says the aforementioned writer, cleanliness and economy of manipulation, and the facilities which it offers for utilizing in almost all cases a much higher percentage of the total quantity of heat produced than it is possible to do with any kind of solid fuel, are facts which will vastly more than compensate for the comparatively small loss of heating power which will be found necessary in the turning of the solid fuel into gas upon a large scale, and which, in the opinion of the writer, will, at no distant day, command attention, and will ultimately result in a revolution in our use of fuel. The employment of gaseous fuel upon a scale of any considerable magnitude has hitherto been almost entirely confined to the utilization of the waste gases of the iron smelting furnace for heating the blast, and the rapidly increasing use for certain metallurgical purposes of Siemens generator gases. By means of the latter it becomes possible in many localities to utilize solid fuel of so poor a quality as to be utterly unfit for direct application to metallurgical purposes, while the gas which it furnishes is easy of application, and is capable of producing without difficulty the highest degrees of heat ever required in such operations. But as a fuel for general application to domestic and manufacturing purposes, the Siemens generator gas has two great drawbacks. First, the total quantity of heat which it is capable of producing for a given volume of gas is quite small in comparison with what can be obtained from some other gases, while, if the comparison were made between equal weights instead of equal volumes, the difference would be greater still, for the Siemens gas is a gas of high specific gravity. Second, this gas always contains a very large percentage of nitrogen, together with smaller quantities of some other gases, which not only add nothing to its heating power, but carry off with them, and render it impossible to utilize, a considerable percentage of the heat actually produced by the combustible ingredients.

The latest experiments on a scale of some magnitude in our cities, in the way of heating buildings and furnishing power for manufacturing purposes, have, he goes on to say, been by the distribution of high-pressure steam through pipes laid in the streets. But these experiments have not hitherto been very successful, and, when we consider the high cost and the great and unavoidable loss of heat and power which always accompany the conveyance of high-pressure steam to any considerable distance in pipes themselves, it is evident that all such methods must eventually disappear before a system which can furnish a cheap gas of great heating power, easily distributed wherever wanted, without requiring pipes to stand pressures of fifty to seventy-five pounds per square inch, and without keeping the whole mass of ground in the streets through which it passes hot, gratis, for a distance of ten to fifteen feet in all directions around the pipes.

The fact is, as we have seen here in New York, this high pressure steam business is not likely to prove either safe or profitable, and, as the REVIEW remarked on a former occasion, the continual obstruction to public business with it is necessitated by a thorough control of this system, would, if there were other objections to it, make it impracticable, at least for large cities.

In the States of New Jersey, New York and Pennsylvania, in which we are told the contesting telephone companies propose to do buisness in competition with the American Bell Telephone Company, we find the territory occupied by some twenty companies, licensees of the American Bell Company, doing all the business at present, and they have, no doubt, worked it for all it is worth during the five years last past. These companies, we find, have an aggregate capital of about $9,000,000, and a total number of subscribers amounting to, say, about 25,000. The average rate, we believe, is about $60 per subscriber, which would be a gross revenue of $150,000—say, a net revenue of $75,000 (not deducting amount necessary for construction, reconstruction and maintenance), which would be about seven per cent. on this capital; but, after providing for construction and reconstruction out of this revenue, we find the net amount greatly reduced. This plant has been rebuilt several times during the past five years. Now, we find, after the best efforts of these men now in control of the field mentioned, that they have only been able to obtain about 25,000

subscribers during the past five years, and their net revenue will hardly, on a liberal estimate, exceed five per cent. on their capital. As we are now asked to subscribe to the stock of these new companies, who, it is said, contemplate competing in these States with the Bell companies above-named, would it not be well to inquire what are their resources from which they propose to pay dividends upon the stock they are offering through their numerous advertisements? We believe the sub-companies representing the competing interest against the Bell companies for the States named are capitalized at $15,000,000. To pay a dividend of six per cent. upon this capital, it would require a gross revenue of about $2,700,000—say. 45,000 subscribers—at an average rate of $60 per annum; and this amount of business would not furnish a net revenue of $900,000, which would be required to pay six per cent. on a capitalization of $15,000,000. Would it not be well for those desiring to invest in telephone stocks to inquire whether the new companies mentioned can go into this field, under the numerous disadvantages which are apparent to every one, and earn a net revenue of $900,000. Granting even that they have a telephone to offer the people, have they also the other equally valuable and necessary apparatus and appliances which go with it, all of which, we believe, are covered by existing patents?

We are not aware that they have any plant in operation as yet, or in fact any means of obtaining any revenue beyond the sale of their stock, which they are offering at such liberal prices.

---

The annual meeting of the Gold and Stock Life Insurance Association was held in Room 48 Era Building, at 5.30 P. M. January 14, 1884. Vice-President Hamilton called the meeting to order, and made a few remarks appropriate to the occasion.

The secretary and treasurer then made their reports, showing the Association to be in a flourishing condition.

On motion, the following important amendments to the constitution and by-laws were made: "To make the regular monthly dues fifty cents, and exempt all new members from assessments on deaths occurring previous to heir initiation."

The meeting then proceeded to the election of officers for the ensuing year, with the following result: President, Daniel E. Pike; vice-president, James E. Hamilton; treasurer, Carl Winkel; secretary, Edward T. Fisher.

Additional members of executive committee—M. Breslin, G. Howard, W. H. Collins, G. C. Scott, A. G. Waring.

---

## Book Reviews.

ELECTRICAL UNITS OF MEASUREMENT. BY SIR WILLIAM THOMSON, F. R. S., M. INST. C. E. PUBLISHED BY THE INSTITUTION OF CIVIL ENGINEERS. LONDON: 25 GREAT GEORGE STREET, WESTMINSTER, S.W.

The pamphlet before us treats of one of the most important sections of electrical science, viz., units of measurement. It is written by so good an authority, so able an electrician, that it is only necessary to mention his name to command attention to what he has to say.

Unlike a class of writers—unhappily large—upon this and kindred themes, Thomson begins at once to explain his views upon that which he essays to treat, without unnecessary ado and circumlocution.

A first essential in physical science, he says, and truly, is to find principles of numerical reckoning and methods for practical measuring, some quality connected with it. For if you cannot express in numbers what you desire to explain, your knowledge of the science must, of a necessity, be meagre and unsatisfactory. It may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of *science*, whatever the matter may be.

Thus, the hardness of different solids, as precious stones and metals, is reckoned by a merely comparative test. Diamond cuts a ruby, ruby cuts quartz, quartz cuts glass-hard steel, and glass-hard steel cuts glass; hence diamond is reckoned harder than ruby, ruby than quartz, quartz than glass-hard steel, and glass-hard steel than glass; but we have no numerical measure of the hardness of these or of any other solids.

We have, indeed, no knowledge of the moduluses of rigidity or of the tensile strength of almost any of the gems or minerals, of which the hardness is reckoned by mineralogists in their comparative scale, beginning with the diamond, the hardest of known solids. We have, Sir William Thomson continues, even no reason to believe that the modulus of rigidity of diamond is greater than that of other solids; and we have no exact understanding of what this property of hardness is, nor of how it is related to moduluses of elasticity, or to tensile or shearing strength, or to the quality of the substance in respect to its bearing stresses exceeding the limit of its elasticity. It must, therefore, be admitted that the science of strength of materials, so all-important in engineering, is but little advanced, and the part of it relating to the so-called hardness of different solids least of all; there being in it no step toward quantitative measurement or reckoning in terms of a definite unit.

"A similar confession," he says, "might have been made regarding electric science, as studied even in the chief physical laboratories of the world, ten years ago. True, Cavendish and Coulomb last century, and Ampère, and Poisson, and Green, and Gauss, and Weber, and Ohm, and Lenz, and Faraday, and Joule, this century, had given us the mathematical and experimental foundation for a complete system of numerical reckoning in electricity and magnetism, in electro-chemistry, and in electric thermo-dynamics; and as early as 1858 a practical beginning of definite electric measurement had been made, in the testing of copper resistances, insulation resistances, and electrostatic inductive capacities, of submarine cables. But fifteen years passed after this beginning was made, and resistance coils and ohms, and standard condensers and micro farads, had been for ten years familiar to the electricians of the submarine cable factories and testing stations, before anything that could be called electric measurement had come to be regularly practised in most of the scientific laboratories of the world. I doubt whether, ten years ago, a single scientific instrument maker or seller could have told his customers whether the specific conductivity of his galvanometer coils was anything within 60 per cent. of that of pure copper; and I doubt whether the resistances of one in a hundred of the coils of electro-magnets, galvanometers, and other electro-magnetic apparatus in the universities, and laboratories, and lecture establishments of the world, were known to the learned professors whose duty it was to explain their properties and to teach their use to students and pupils. But we have changed all that, and now we know the resistances of our electro-magnetic coils, generally speaking, better than we know their lengths; and our least advanced students in physical laboratories are quite able to measure resistances through a somewhat wide range with considerable accuracy. I should think, indeed, that with the appliances in ordinary use they are more likely to measure resistances of from 100 to 10,000 ohms to an accuracy of $\frac{1}{10}$ per cent., than they are to be right to one millimeter in a meter in their measurements of length. It certainly is a very surprising result, that in such a recondite phenomenon—such a subtle quality to deal with—as electric resistance, which is so very difficult to define, and which we are going to learn is a velocity, every clerk in a telegraph station, the junior students and assistants in laboratories, and even workmen in electric lighting establishments, are perfectly ready to measure more accurately than you would measure the length of ten feet of wire, the resistance of electric conductors in definite absolute units."

Probably nearly every physical laboratory possesses a micro-farad, but it is very doubtful if the pedigrees of these are always known and if their accuracy within ten per cent. were called in question it is ten to one that in most cases no one, neither maker nor possessor, nor electrical expert could be found to defend it.

As for the electro-static apparatus, Prof. Thomson himself confesses that he does not know the capacity of a single one of the two or three dozen Leyden jars which in 1846, he inherited in the Natural Philosophy apparatus room of the University of Glasgow, or which he has made from time to time during the thirty-seven years since. Now the reckoning of Leyden jar capacity in square inches of coated glass—thickness and specific inductive capacity not stated—ought to be as much a thing of the past, as is the reckoning of resistances in terms of a mile of wire—weighing fourteen grains to the foot, of ordinary commercial copper, specific resistance not stated (perhaps 45 per cent.? or 70 per cent.? or 98 per cent.? of the conductivity of pure copper).

And as to practical measurement of electro-motive force, says Prof. Thompson, we have scarcely emerged one year from those middle ages when a Volt and a Daniell's cell were considered practically identical—to the higher aspiration of measurement within one per cent.

Those who, like a certain Maryland professor, who recently read a paper before the Academy of Sciences, are wont to look with such a contempt upon applications of science, would do well to carefully consider what Prof. Thomson says upon the subject. Here it is:

"There cannot be a greater mistake, than that of looking superciliously upon practical applications of science. The life and soul of science is its practical application, and just as the great advances in mathematics have been made through the desire of discovering the solution of problems which were of a highly practical kind in mathematical science; so in physical science many of the greatest advances that have been made, from the beginning of the world to the present time, have been made in the earnest desire to turn the knowledge of the properties of matter to some purpose useful to mankind."

In his consideration of electrical units of measurement, Prof. Thomson says that the absolute system goes from beginning to end in a perfect'y consistent manner, with the initial conditions carried out all through; one of which, in the electro-magnetic system, is that the electro-magnetic force produced by the motion at unit speed, across the lines of force of a field of unit intensity, of a unit length of conductor, is unity. That, he says, you must carry out if the system is to be complete and consistent, and the dimensions of all your instruments and apparatus must all be reckoned uniformly in terms of the unit of length adopted in the absolute definition. The ohm is 1,000,000,000 centimeters or 10,000 kilometers per second. "If," says the author, "we are to make the ohm an absolute electro-magnetic unit with the second as the unit of time, we must take the earth's quadrant as the unit of length. If we take that consistently throughout, we need never leave this particular system, and we need have nothing to do with C. G. S. We should have the Q. G. S. system pure and simple! But it would be obviously inconvenient to measure the dimensions of instruments, the diameters of wheels, and the gauges of wire in submultiples of the earth's quadrant. Imagine the horror of a practical workman, on hearing a scientific person say to him, 'Give me a wire 1/1,000,000 of an earth-quadrant long, and 1/10,000,000,000 in diameter.' Now wherein does the so-called practical system differ from the absolute system, and why is it not to be as logical and complete as the absolute system? We would never leave the absolute system, if it gave us in all cases convenient numbers; and it does give us convenient numbers for the measurement of a current, its unit being ten times the 'ampère' of the practical system. The unit of resistance in C. G. S., however, is too small, so is the unit of electro-motive force. To get convenient numbers, we give names to certain multiples of units, that is all; and we use these multiples just as long as it is convenient, and not any longer. That is my idea of the practical system—to use it for convenience and as long as it is convenient; the moment it ceases to to be convenient, to throw it overboard and take C. G. S. pure and simple. The Conference at Paris decided upon the practical system, by adopting the units which are now so familiar, the ohm, the volt (taken from the British Association recommendation), and the ampère. The coulomb was also added, and it was most satisfactory to get old Coulomb's name in—one of the fathers of electrical science. Then the Watt was added by Sir W. Siemens, and it has been generally accepted, and has proved exceedingly convenient. But when you go farther with the practical system, and take anything that involves a magnetic pole or a magnetic field, you get lost in the trouble of adopting the earth's quadrant as unit of length, and the deviation from C. G. S. ceases to be convenient. Return then to C. G. S. pure and simple."

The velocity at which the surface of a globe must shrink towards the centre, to keep its potential constant, when it is connected to the earth by a wet thread measures, says Prof. Thompson, the conducting power of that wet thread. Double conducting power, he continues, will require double velocity of shrinkage; that is, the globe must shrink twice as fast not to lose its potential. With a very long semi-dry thread, the globe may shrink slowly. Suppose we have a globe insulated in the air of a room for electrical experiment, and connected with the ground by a silk thread. If you have an electrometer to show the potential, you will see it gradually sink. You may imagine that dust in the air would carry off electricity, but in truth, practically, the sole loss is by this semi-dry thread. When we see the potential sinking, we can imagine we see the globe shrinking slowly so as to keep its potential constant, while it is gradually losing its electrical charge, little by little; the velocity with which the surface must shrink toward the center to keep the potential constant, measures the conducting power of the thread in electrostatic measure. Thus we learn how it is a velocity which measures in electrostatic measure the conducting power of a cercertain thread or wire.

But, as we have seen in electro-magnetic measure, the resistance of the same thread or wire is measured by another velocity. The mysterious quantity "V" is the square root of the product of the two velocities. Or it is the one velocity which measures in electro-magnetic measure the resistance, and in electrostatic measure the conductivity, of one and the same conductor, which must be of about 29 ohms resistance, because experiment has proved "V" to be not very different from 290,000 kilometers per second.

Speaking of conductivity, Prof. Thomson says: "We have the name 'conductivity,' but we want a name for the unit of conductivity. I made a box of resistance coils thirty years ago, and another fifteen years ago, for the measurement of conductivity, and they both languished for the want of a name. My own pupils will go on using the resistance box in ohms, rather than the conductivity box, because it is so puzzling to say, 'The conductivity is the reciprocal of the sum of the reciprocals of these resistances.' It is the conductivity that you want to measure but the idea is too puzzling; and yet for some cases the conductivity system is immensely superior in accuracy and convenience to that by adding resistances in series. For the reciprocal of an ohm in the measurement of resisting power—for the unit reckoning of conductivity which will agree with the ohm—it is suggested to take a phonograph and turn it backwards, and see what it will make out of the word 'ohm.' I admire the suggestion, and I wish some one would take the responsibility of adopting it; we should then have *mho* boxes of coils at once in general use. With respect to electric light, what is it we want to measure by the current galvanometer? We have a potential galvanometer, and we have a current galvanometer. Everybody knows what we want to measure with the potential galvanometer. The servant in every house that is lighted

electrically knows about potentials; and if in reading the galvanometer he sees it is down to 80 volts he knows that something is wrong, and will at once go to the engine-room and cause 84 volts to be supplied; supposing, for example (as in the case of my own house, temporarily, until I can get two-hundred-volt lamps), that the proper potential is 84 volts. But in the current galvanometer there are so many divisions indicating, it may be, the number of ampères in the current. But, after all, what do we want besides a knowledge of the potential? It is the sum of the reciprocals of the resistances in the circuit. In the multiple-arc system each fresh lamp lighted adds a conductivity. In a circuit of hundred volt lamps, in each of which you have a current of 0.7 of an ampère, and therefore a resistance of 143 ohms, how convenient it would be in putting on a lamp—adding a certain conductivity—if we could say we add a *mho*, or a fraction of a *mho*, as the case may be. I do not say that *mho* is the word to be used, but I wish it could be accepted, so that we might have it at once in general use. We shall have a word for it when we have the thing, or rather I should say, we shall have the thing when we have the word." The Appendix to the 1862 Report of the first British Association Committee on Electric Measurements contains a description of a "Resistance Measurer," invented by Sir William Siemens, and a "Modification of Siemens Resistance Measurer," by Prof. Jenkin.

This instrument, says Prof. Thomson, gives directly the resistance of a conductor by means of an instrumental adjustment, bringing a magnetic needle to a zero position for each observation. In the original Siemens instrument the adjustment is a shifting of two coils by translational motion, and the conductivity is read on a scale of equal divisions adopted by means of a curve determined by experiment to give a reading of the required resistance. In Jenkin's modification the mechanical arrangement is much simplified by the adaptation of a different electro-magnetic combination; and the required resistance is given by the tangent of the angle through which the coils must be turned to bring the needle to zero. A similar instrument to give conductivity by a simple reading without any adjusting or setting for each observation is easily made Prof. Thomson made such an instrument in 1878, being simply a galvanometer with controlling resistance coils instead of controlling magnets. Such an instrument at once gives conductivity, and if a name is wanted Prof. Thomson advises the adoption of *mho* for the unit of conductivity, and that the instrument be called a *mhometer*. The rule, he says, would be: The reciprocal of the sum of the reciprocals of mhos is equal to the number of ohms; and the reciprocal of the sum of the reciprocals of ohms is equal to the number of mhos. The number of mhos or of millimhos will then measure the number of lamps in the circuit.

The domestic incandescent lamp of the early future ought, in the opinion of Prof. Thomson, to be a one-millimho lamp, to give a 10 or 12 candle light with the Board of Trade regulated 200 volts of potential. Thus the lamp galvanometer or lamp meter, may have its scale divided to one millimho to the division and the number read on its scale at any time will be simply the number of lamps lighted at the time. The instrument will also have the great advantage of being steady notwithstanding the variations of the engine.

A potential instrument on an electric light circuit at best is always somewhat variable, because the potential varies a good deal—within 1 or 2 per cent. perhaps—but the resistance in the lamps varies exceedingly little. The mho-meter will, in these circumstances, be an absolutely steady instrument; it will not quiver even though the engine is irregular. The potential galvanometer will show you how much unsteadiness there is, to be complained of or to be connected.

Lastly, Prof. Thomson speaks of the objects to be aimed at in respect to the use of this great system of units. Nothing can be much more satisfactory, he says, than is the measurement of somewhat large resistances as we have it habitually at present; but if we meant a little more method for low resistance it will be helped very much by the use of the mho boxes of conductivities which Prof. Thomson has indicated.

The great thing wanted now, in the way of practical electro-measurement, he says, is a good standard of electro-motive force. That was a chief object of a recent British Association Committee, but it has not yet been satisfactorily attained for practical purposes. Standard cells serve for the purpose to some extent, but we want something better, something of the nature of an electro-dynanometer, to give a good, steady idiostatic potential gauge by which the constant of any electro-meter or ordinary galvanometer may be easily and accurately tested.

As to the science of electricity, says Prof. Thomson, the great want in the way of measurement just now is the accurate measurement of ("V"), the ratio between the electro-static and the electro-magnetic units, and it is to be hoped that scientific investigators will take the matter up and give to it an accuracy like that which Lord Rayleigh has given to the measurement of the ohm. "Joule," says Prof. Thomson, "with a modesty characteristic of the man, and with a magical accuracy characteristic of his work, made, at the request of the British Association, an investigation of the heating effect of a measured current in a definite way according to the measure of resistance of the British Association ohm, supposed then to be $10^9$ C. G. S. units of resistance, and he himself considered that the electrical measurement which he then made was more accurate than his old frictional measurement of the mechanical equivalent of the thermal unit could be.

The result obtained, assuming the British Association ohm to be absolutely correct, gave the mechanical equivalent as 782.2 foot-pounds, instead of 772, which he had made it before, and he expressed himself willing to make a new determination of it by the frictional method. But now let us put ourselves in the position of 1866, the date of this report, with these competing determinations of the ohm: that obtained by the British Association method of spinning coils, and by Joule's electro-thermal method with the dynamical value of the thermal unit, as was given by his frictional method. Supposing that his electro-thermal method was right, then what we are to infer is not that the result is the mechanical equivalent, but that the British Association unit was not $10^9$, as it was supposed to be, but $10^9 \times 0.98699$. Thus, this experiment was virtually Joule's determination of the resistance of the British Association ohm in absolute measure. Lord Rayleigh's determination is $10^9 \times 0.98677$, a difference of 2 in the 4th place, within about 1/50 per cent. There is perfect magic in the accuracy of Joule's work; it is not a matter of chance. I think, between Joule, Lord Rayleigh, Mrs. Sidgwick, and others, we cannot have much doubt now what is the absolute value of the Siemens unit, or of the British Association unit. I advise everybody to take the Rayleigh ohm unit, instead of the British Association ohm. I have begun to do so, and I mark everything R. O. You may have everything in the British Association unit, but reduce, if you please, to Rayleigh ohms by the reducing factor 0.98677. Volts must be reduced in the same ratio. The old estimate which I made in 1851 from Joule's experiment, for the absolute electro-motive force of a standard Daniell cell, was 1.07 volts; and after thinking it was 1.078 for ten years, because of the British Association unit, we come back to correct it, and find it is 1.07. So much for the volt. But we want far more accurate instruments and methods connected with other parts of electric measurements, especially electromotive force and capacity, electro-static, or electro-magnetic, with the comparing number "$v$." These are the things we want to advance and perfect, to give a satisfactorily scientific character to this great system of absolute measurement, of which I have endeavored to trace and explain the origin."

## Baltimore and Ohio Buys the National Line—Great Extensions Contemplated.

Negotiations were completed the 28th, by which the Baltimore and Ohio Telegraph Company became the owner of the property of the National Telegraph Company.

The National Telegraph Company was organized about three months ago by some of the directors of the New York, West Shore and Buffalo and the Nickel Plate Railroad Companies, to purchase and capitalize the telegraph lines along the two roads from this city to Chicago. The property, consisting of four wires, was capitalized for $1,000,000.

One-half of the stock was held by the North River Construction Company, which built the West Shore Road and owns a majority of its stock, and the other half by the Nickel Plate interest. The two sold, on the 28th inst., their entire holdings for $800,000, or $80 a share, to Robert Garrett's Sons, of Baltimore, who represented the Baltimore and Ohio Telegraph Company. The property was immediately turned over upon the payment of $200,000 on account, and Vice-President and General Manager D. H. Bates, of the Baltimore and Ohio Company, was elected to the same office in the National. Joseph B. Stewart, late of the Western Union Telegraph office in this city, has been appointed Acting Superintendent of the Baltimore and Ohio Telegraph Company, in place of Robert Stewart, resigned.

Mr. Robert Garrett, Vice-President of the Baltimore and Ohio Railroad, is stopping at the Brevoort House.

When spoken to about the purchase of the National Telegraph Company, he said that it had been acquired as a part of a general plan which had been matured for the extension of the Baltimore and Ohio telegraph system.

"The National Telegraph Company," he said, "had four wires between New York and Chicago. Orders have been issued for the stringing of twelve additional wires. The purchase of this telegraph line gives the Baltimore and Ohio Telegraph Company a connection with the Canada telegraph system, which we reach at Detroit and Buffalo.

They have made contracts for a huge amount of telegraph material to be used in building a number of new lines. Just as soon as the frost comes out of the ground, so that poles can be set, we shall begin the construction of a line from New York to Boston, and we shall have another line through the Pennsylvania oil regions. A contract was awarded last Saturday for lines from Chicago to Milwaukee, St. Paul, Minneapolis, and other points as far north as Winnipeg, and as far west as Bismarck. We shall also build lines south from St. Louis to New Orleans and Galveston. We shall establish district telegraphs in New York, Chicago, and other cities, for general messenger service as well as the delivery of dispatches. The call boxes will have a return signal attachment, so that the person using one will know that his call has been received and is being attended to. We shall largely increase our offices in New York city.

Mr. Garrett stated that although the Baltimore and Ohio Telegraph Company is a distinct corporation, it is controlled by the Baltimore and Ohio Railroad, which advances it the necessary capital. The policy of the company would be to reach all the large towns and cities where commercial business is to be secured. "Telegraphic competition will not be confined to land business," Mr. Garrett said. "I am advised that the cable steamship Faraday will start for this side to commence the laying of the new Atlantic cable by the latter part of February, and the cable will be laid and ready for business by the 1st of August."

It is stated that the Jersey Central Railroad has given notice to the Western Union that at the termination of the existing contract, which will soon expire, it will work its own wires. It is understood that the Jersey Central line will be operated in connection with the Baltimore and Ohio system.

## Franklin Institute Exhibition.

For the convenience of exhibitors arrangements have been made with us to attend to all matters pertaining to the entry of goods at the Custom House in Philadelphia or New York, the transportation of the same from the port of entry to the exhibition building, and in the exportation at the close of the exhibition, or their withdrawal for sale. Shippers desiring our services will please consign goods, both on invoice and bill of lading, to us, and send documents as follows: 1. When shipped direct to Philadelphia, two invoices (one consular and one copy), and two bills of lading, to be sent to the Committee on Exhibitions, Franklin Institute, Philadelphia, U. S. A. 2. When shipped *via* New York, one consular invoice and one bill of lading, to John A. Norman, 72 Wall Street, New York; one copy of invoice and one bill of lading to Committee on Exhibitions, Franklin Institute, Philadelphia, U. S. A.

E. H. Bailey & Co.,
406 Liberty St., Phila.

The proposed arrangement of Messrs. E. H. Bailey & Co., and their charges for services, have met with the approval of the Committee on Exhibitions. Wm. H. Wahl, Secretary of the Franklin Institute.

---

The increasing use of electricity in various ways is indicated by the publication of the Electrical Review (New York). It is a handsomely got-up weekly, well illustrated, and full of the latest information regarding electric lighting, and other applications of that much talked-about but still very imperfectly known something which we call electricity.—*The Canadian Manufacturer and Industrial World.*

---

Mr. Patrick, of the firm of Patrick & Carter, the well-known manufacturers of telegraph instruments and supplies, of Philadelphia, has sailed for a three months' voyage to the West Indies, in the schooner Lizzie H. Patrick, of which he is the principal owner.

---

In the manufacture of telegraph instruments Messrs. J. H. Bunnell & Co seem to be doing a rushing business. They have now 100 men, working full time, turning out telegraph apparatus.

---

D. H. Bates, the new President and General Manager of the Baltimore and Ohio Telegraph Company, said yesterday: "You can deny, in unqualified terms, the report that I accepted this position in the interest of the Western Union Telegraph Company. My appointment as President of the Baltimore and Ohio Telegraph has no significance whatever so far as the Western Union is concerned." A report was current that Mr. Bates, who has been for so many years Gen. Eckert's intimate friend and assistant, had merely gone from the employ of the Western Union to that of the Baltimore and Ohio for the purpose of bringing the two corporations into a closer relationship. Mr. Bates was very emphatic in his assurances that he had cast his lot with the Baltimore and Ohio for good, and that the last named company was "in the telegraph business on its own hook, and very much in earnest."

---

Washington, Jan. 29.—Mr. Platt offered in the Senate to day the following series of resolutions, for the immediate consideration of which he asked unanimous consent, but under the objection of Mr. Sherman they went over until to-morrow:

*Resolved*, That the Committee on Post Offices and Post Roads is hereby instructed to inquire whether the cost of telegraphic correspondence between the several States and Territories of the United States or with foreign countries has been injuriously affected by large stock dividends made by the Western Union Telegraph Company, by consolidations between different telegraph companies, by working contracts with cable or other companies, by the leasing of connecting, competing, or other lines, or by other means.

*Resolved*, That said committee further inquire whether the Western Union Telegraph Company, directly, or through the Gold and Stock Telegraph Company, or any other company or association, have prescribed rules or regulations for the transmitting of press news or made differential rates, whereby discriminations are made restricting the free and independent use of the telegraph by the press.

*Resolved*, That said committee be empowered to ask for persons and papers, employ a stenographer, and report by bill or otherwise and in print.

# ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JANUARY 22, 1884.

292,153 Magneto-electric generator; William J. Bowen, Norwalk, Ohio, assignor to himself, T. T. Keckeler, Cincinnati, Ohio, and Z. C. Thwing, Marshall, Mich.

292,178 Explosive gas engine; Alexander Kirk Rider, Waldon, N. Y.

292,180 Electrical connector; Stephen Rider, North Attleborough, Mass., assignor of one-half to Joseph Lewis Blaine, same place.

292,193 Apparatus for transmitting electric signals; Bruno Ardank-Abakanowicz, Paris, France.

292,208 Telephone transmitter; Joseph H. Cheever, Somerville, Mass.

292,212 Telephonic transmission; William H. Eckert, New York, N. Y.

292,293 Electric arc lamp; Frederick K Fitch, New York, N. Y.

292,310 Electric battery; Ida C. Himmer, New York, N. Y.

292,311 Magneto-electrical alarm; Joseph R. H. Hinton, Baltimore, Md., assignor to the Viaduct Manufacturing Company of Maryland.

292,317 Electric distress signal; Thos. B. Joseph, Alpena, Mich., assignor of one-third to William H. Patten, Philadelphia, Pa.

292,324 Incandescent electric lamp; Edward R. Knowles, Brooklyn, N. Y., and Frank E. Idell, Hoboken, N. J., assignors to the Consolidated Electric Light Company, of New York.

292,335 Magneto-electro-telephone; Thomas D. Lockwood, Malden, and Thomas W. Lane, Boston, Mass.

292,374 Tip for electric gas burners; Adolph T Smith, New York, N. Y.

292,382 Regulators for electric motors; Levi W. Stockwell, Cleveland, Ohio.

292,397 Regulator for dynamo-electric machine; Edward H. Amet, La Grange, assignor of one-half to Herbert A. Streeter, Chicago, Ill.

292,403 Reflector for incandescent lamps; Joseph S. Beeman, London, England.

292,433 Galvanic battery: Thomas James Howell, London, England.

292,447 Holder for incandescent electric lamps; Alfred Swan Gateshead, County of Durham, England.

**A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.**

## BUSINESS NOTICES.

A. C. NORTHROP, Waterbury, Conn. Iron and Brass Machine Screws, Zinc in Sheets and Plate for Electrical Purposes, Parts for Telephone and Telegraph Instruments, Manufactured from Iron, Brass, Steel or Zinc.

A. G. DAY, Kerite Insulated Telegraph and Telephone Wire and Cables, Anti-induction Kerite Telephone Cables, CLARKE B. HOTCHKISS, New York. Send for circular and prices.

A. L. BOGART, New York. Electric Gas Lighting Apparatus. Annunciators for Hotels and Houses.

ALFRED MOORE, Philadelphia, Pa. Telegraph, Telephone, Electric Light, Office, Line and Annunciator Wire.

AMERICAN BELL TELEPHONE CO., Boston, Mass. Electric Speaking Telephones for Exchange Systems, Private Lines, and Speaking-tube Lines.

AMERICAN ELECTRICAL WORKS, Providence, R. I. Patent Finished Insulated Electric Wires, Telephone and Electric Cordage. Electric Light Wire, Magnet Wire, Patent Rubber covered Wire, Aerial and Underground Cables, &c., &c. Send for prices.

AMERICAN SPIRAL TELEPHONE WIRE CO., Boston, Mass. Spiral Telephone Wire for long and short distance Telephoning. Write for information.

ARMINGTON & SIMS, Providence, R. I. Engines for Electric Lighting and general use.

AUSTIN GALLAGHER, New York. Keith Electric Light System complete for Arc Lighting. Stock for sale.

B. W. PAYNE & SONS, Corning, N. Y. The Payne Single and Double Valve Automatic Engine. Send for catalogue.

BERGMAN & CO., New York. The Bergman and Hald Battery for Telephone and Telegraph purposes. Send for circular.

BOULTON CARBON CO., Cleveland, Ohio. Carbons for Electric Light purposes. Send for quotations.

BRUSH ELECTRIC CO., Cleveland, Ohio. Arc Lights and Brush Storage Batteries.

BUFFALO ELECTRIC WORKS, Buffalo, N. Y. Carbon Points and Plates.

BUTLER SAFES, New York. Fire and Burglar-Proof.

CHARLES WILLIAMS, JR., Boston, Mass. Call Bells, Electric Bells, District Bells, Switch Boards, Annunciators, &c., &c. Write for quotations.

CHICAGO INSULATING CO., Chicago, Ill. The Fiske-Mott High-resistance Insulator. Send for circular.

CHROME STEEL WORKS, Brooklyn, N. Y. Steel for Magnets a specialty; Chrome Cast Steel.

COE BRASS CO., Torrington, Conn. Brass, Copper and German Silver in every variety of Sheets, Rolls, Plates, Wire, Rods and Blanks or Shells. Pure Lake Superior Copper Wire and Battery Zincs. Write for price list.

D. VAN NOSTRAND, New York. Scientific Books. Send for circular.

ELECTRIC GAS LIGHTING CO., Boston, Mass. Improved Electric Gas Lighting Apparatus.

ELECTRIC STORAGE AND LIGHT CO., Boston, Mass. Own patents for Faure's Storage Batteries for territory of Rhode Island, Connecticut and Massachusetts.

H. M. RAYNOR, New York. Platinum for all purposes.

HOLMES, BOOTH & HAYDENS, New York. Fireproof Electric Light Wire, Patent "KK" Insulated Copper and Iron Wire for Telephone and Telegraph use. Send for catalogue and prices.

I. W. COLBURN & CO., Fitchburg, Mass. Dynamo Electric Machines.

IVISON, BLAKEMAN & TAYLOR, New York. Ink of all kinds and colors. Circulars sent on application.

JOHN H. MUEGGE, New York. Platinum, Chemical Apparatus, Crucibles, etc.

LECLANCHE BATTERY COMPANY, New York. The Great Telephone Battery. Write for description and prices.

J. H. BUNNELL & CO., New York. The Morse Learner's Instrument, Telegraph Instruments of all kinds, Telephone and Telegraph Supplies. Illustrated Works on Electrical Measurement, and the Galvanometer and its uses. Send for catalogue.

LAW TELEGRAPH CO., New York. The Law Battery for Telephone and Telegraph purposes.

LOCKWOOD & FOSTER, New York. Learners' Telegraph Instrument.

MUTUAL DISTRICT MESSENGER CO., Boston, Mass. Addressing and Distributing Circulars &c., &c. D. J. Hern, General Manager.

NEW ENGLAND BUTT COMPANY, Providence, R. I. Braiding Machinery for covering Telegraph, Telephone and Electric Light Wire, Single and Double Winders and Braiders of every description; also Fine Castings. Send for catalogue.

O. W. MADDAUS, New York. Designer and Engraver.

PAINE & LADD, Washington, D. C. Attorneys in Patent Causes, and Solicitors of Patents.

PALMER WIRE CO., Palmer, Mass., and New York. Galvanized Telephone and Telegraph Wire Iron and Steel Wire of best quality. Material, finish and conductivity. Write for quotations.

PARTRICK & CARTER, Philadelphia, Pa. Electric Annunciators, Learners' Instruments, Batteries and Telegraph and Telephone Supplies. Write for circulars.

PHOSPHOR BRONZE SMELTING CO., Philadelphia, Pa. Telephone Wire, insulated and bare.

RHODE ISLAND TELEPHONE & ELECTRIC CO., Providence, R. I. Manufacturers of the Providence Telephone Switch Boards, Breckenridge Jacks, Wright Cable Clips, Howard Safety Appliances, &c.

SCHLEICHER, SCHUMM & CO., Philadelphia, Pa. Manufacturers of the Otto Gas Engine. Write for catalogue.

STANDARD ELECTRICAL WORKS, Cincinnati, Ohio. Manufacturers of Telegraph and Telephone Instruments, Magneto Bells, Switch Boards and Telephone Exchange Apparatus, Annunciators, Wire, Batteries, Insulators, Electric Light Wire and Supplies. Send for circular and prices.

SWAN INCANDESCENT ELECTRIC LIGHT CO., New York. Incandescent Lights, and Complete Apparatus. Send for illustrated catalogue.

THE ANSONIA BRASS AND COPPER CO., New York. Pure Electric Copper Wire for Magnets, Telephone Lines, and Electric Light purposes, Office Wire, Zinc Rods and Battery Copper.

THE BISHOP GUTTA PERCHA WORKS, New York. Gutta Percha Insulated Submarine Telegraph Cables, Subterranean Telegraph Cables, Aerial Telegraph Cables, Lead or Hempen covered Torpedo Cables, Lead-covered Cables, Telephone Cables of all kinds —G. P. Office Wire, and Marks' Compound Insulated Wire, &c., &c. Send for catalogue.

UNITED STATES ELECTRIC LIGHT CO., New York. Arc and Incandescent Lights, complete and reliable systems, &c. Write for information.

VIADUCT MANUFACTURING COMPANY, Baltimore, Md. Electrical Goods of every description. Electric Light and American District supplies. Send for price-list.

VICTOR, BISHOP & CO., New York. Platinum for all Manufacturing, Chemical and Electrical purposes. Send for prices.

WATTS, CAMPBELL & CO., Newark N. J. Improved Corliss Steam Engines. Send for catalogue.

WESTERN ELECTRIC CO., New York, Boston, and Chicago. Telegraph and Telephone Apparatus and Supplies of every description. Send for catalogue.

THOMPSON-HOUSTON ELECTRIC LIGHT CO., Boston, Mass. Automatic Self-regulating System of Arc Lighting.

THE ELECTRICAL SUPPLY CO., New York. Electric Light, Telephone and Telegraph Supplies. Send for price list and catalogue.

THE RHODE ISLAND BRAIDING MACHINE CO., Providence, R. I. Braiding and Winding Machinery for covering all kinds of Telephone, Telegraph and Electric Light wire.

TRENTON IRON CO., Trenton, New Jersey. Galvanized Iron and Steel Wire of all kinds for Telephone and Telegraph purposes. Write for prices.

WM. A. HARRIS, Providence, R. I. The Harris-Corliss Steam Engines and Light and Heavy Castings.

WM. A. HARRIS, Providence, R. I. Harris-Corliss Steam Engines and light and heavy Steam Castings.

UNION ELECTRIC MANUFACTURING CO., New York. Manufacturers of all kinds of Telegraph, Telephone and Electric Light Apparatus. Send specifications.

REMOVAL NOTICE.—We have removed our principal office and manufactory to our new building, 227 to 251 South Clinton street. Please direct future communications to that address, and oblige,

Yours, respectfully,
WESTERN ELECTRIC COMPANY.
Chicago, January 15, 1884.

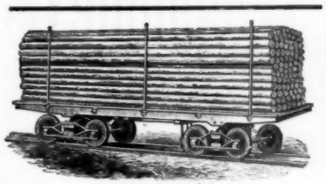
## Average Telephone Stock Quotations.

| | |
|---|---|
| American Bell Telephone Company | 178 |
| Central New York Telephone and Telegraph Company | 100 |
| Empire State Telephone and Telegraph Company | 198 |
| Hudson River Telephone and Telegraph Company | 100 |
| New York and New Jersey Telephone Company | 86 |
| Mexican Telephone Company | 2½ |
| New York and Pennsylvania Telephone Company | 70 |
| Southern Bell Telephone and Telegraph Company | 126 |
| Tropical Telephone Company | 2½ |
| Central Union Telephone Company | 100 |
| Iowa Union " " | 91 |
| Missouri and Kansas Telephone Co. | 98 |
| United Telephone Company (Kansas and Missouri) | 97 |
| Bell Telephone Company, of Missouri | 160 |
| Wisconsin Telephone Company | 120 |
| Cumberland Telephone Company | 100 |
| Great Southern Telephone Company | 100 |
| Michigan Telephone Company | 105 |
| Chicago Telephone Company | 282 |
| Erie Telephone Company | 39 |
| Union Telephone Company | 100 |
| Southern New England Telephone Company | 170 |
| New England Telephone Company | 63 |
| Chesapeake & Potomac Telephone Co. | 100 |

## Average Market Quotations of Battery Supplies for the Week Ending January 31, 1884.

| | |
|---|---|
| Disque Leclanche Battery, per cell | 90c. |
| " " Porous Cups | 75c. |
| " " Jars | 25c |
| Prism Leclanche Battery, per cell | $1.25c. |
| " " Prisms, per pair | 90c. |
| " " Carbons | 30c. |
| " " Jars | 25c. |
| " " Jar cover | 12c. |
| Leclanche zincs | 12c. |
| Crow foot, 6x8, per cell | 75c. |
| Callaud Zincs | 30c. |
| " Coppers | 18c. |
| " Jars | 25c. |
| Sal Ammoniac, per lb | 12½c. |
| Blue vitriol, per lb | 6½c. |
| " " bbl., lots, per lb | 5½c. |
| Sulphate of zinc | 10c. |
| Battery syringe | $1.90c |
| Battery brush | 20c. |
| Hydrometer | 50c. |

Send to our advertisers for price lists.




CEDAR
TELEGRAPH POLES
From 25 to 60 Feet in Length.
Seasoned ready for immediate delivery. The Largest and Best Selected Stock in Michigan. We quote prices delivered at any Railroad Station in the United States.
BROWNLEE & CO.,
DETROIT, MICH.
[Please mention this paper.]

JARVIS ENGINEERING CO. BOSTON.
Boilers Set with the Jarvis Patent Furnace to burn pea coal, Screenings or Slade without a blower. Send for Circulars.

NOW READY.
Electrical Measurement,
AND
The Galvanometer and
Its Uses.
BY T. D. LOCKWOOD.
144 pages, handsomely bound, large clear type, and fully illustrated with diagrams of connections, engravings of apparatus, etc. Price, $1.50. Sent by mail, Postpaid, to any Address upon receipt of price.
Every Telegraph Office Manager, or Telegraph Operator, every Telephone Central or District Telegraph Manager, every Student of Electrical Science, every person having charge of Electric Light Plant, or other Electrical Arrangements and Apparatus, and every person who takes an interest in Electrical Matters of any kind, should read
T. D. LOCKWOOD'S
"Electrical Measurement and the Galvanometer."
It is the only book which EXPLAINS in PLAIN ENGLISH and without algebraic formulae all about Electric Measurement and the Use of Galvanometers, besides giving fully detailed and illustrated description of
GALVANOMETERS & RHEOSTATS,
with all diagrams of connections required in using them, and the plain and simple reason why for everything.
In this remarkable book the whole subject of Electrical Measurement is made so clear and plain that ANY ONE can easily understand every explanation, and can practically make electrical measurements without difficulty, and especially without "doing" sums in algebra.
PUBLISHED BY
J. K. BUNNELL & CO.
112 Liberty Street, New York,
TO WHOM ALL ORDERS SHOULD BE SENT.

PAINE & LADD,
HALBERT E. PAINE, Late Commissioner of Patents. STORY B. LADD.
Attorneys in Patent Causes
And Solicitors of Patents,
WASHINGTON, D.C.

INCANDESCENT LAMP
WANTED.
Inventors of Incandescent Lamps wishing to sell patents can send description, terms, and specimen lamp to H, care of ELECTRICAL REVIEW, 23 Park Row, New York.

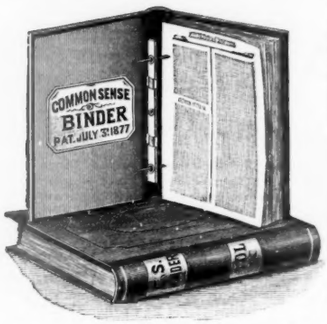
THE
Long Scented Telephone
(Patent Applied for),
The Great Novelty of the Age,
and Toilet Article,
NON-ELECTRIC TELEPHONE.
Sold outright for two dollars per set. Address all orders to
J. A. SEELEY, General Manager,
LONG SCENTED TELEPHONE CO.,
191 E. SEVENTY-SIXTH ST.,
NEW YORK CITY.

THE TROPICAL AMERICAN TELEPHONE CO., (LIMITED.)
SOLE AUTHORIZED EXPORTERS OF
Patented Telephones & Telephonic Apparatus
FROM THE UNITED STATES TO SOUTH AMERICA, CENTRAL AMERICA, MEXICO, AND THE WEST INDIA ISLANDS.
No. 93 Milk Street, Boston, Mass., U. S. A.

# BINDERS

—FOR THE—

## ELECTRICAL REVIEW,




We are now prepared to furnish for the convenience of subscribers to the

—REVIEW—

*Or for any other Electrical Journal published in this Country,*

one of the latest improved self-binders. The binders are of the exact size of the paper, and each issue, as received, can be filed in it without trouble. When the volume is complete at the end of the year, it can be permanently fastened in a moment, making in appearance a volume almost as durable as one specially bound. The binder will be sent, postage prepaid, to any part of the United States, on receipt of $1.00. Address,

**DELANO & COMPANY,**

P. O. BOX, 3329. 23 Park Row, New York.

JUST OUT.

## ELECTRICITY

In Theory and Practice,

Or the Elements of Electrical Engineering

BY

**Lieut. BRADLEY A. FISKE, U.S.N.**

PRICE $2.50.

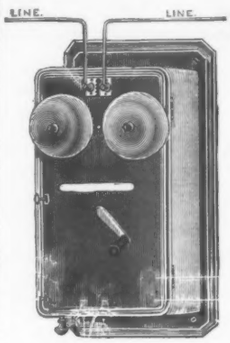
**8vo. Cloth, 180 Illustrations.**

Copies sent postpaid by mail, on receipt of price.

**D. VAN NOSTRAND, Publisher.**

**23 Murray and 27 Warren Streets, NEW YORK.**

Complete Catalogue of Electrical Books will be sent to any address on application.




## Viaduct Manufacturing Co.

**OF BALTIMORE.**

(Successors to late firm of DAVIS & WATTS.)

**A. G. DAVIS, President.**

ELECTRICAL GOODS OF EVERY DESCRIPTION.

**Telephone, Telegraph, Electric Light and American District Supplies.**

SEND FOR ILLUSTRATED CATALOGUE,

## MAGNETO SIGNAL BELLS.

NO BATTERY REQUIRED.

**$4, to $5, each. Discount on large lots.**

# STANDARD ELECTRICAL WORKS,

—MANUFACTURERS OF—

## Telegraph and Telephone Instruments,

EXCLUSIVE MANUFACTURERS AND PATENTEES OF THE

"CELEBRATED POST" (NEW GEAR WHEEL) MAGNETO BELL,

Manufacturing Licensees of the AMERICAN BELL TELEPHONE COMPANY,

Magneto Bells, Switch Boards and Exchange Apparatus,

MANUFACTURERS OF

House and Hotel Annunciators, and Burglar Alarms, &c., Same Furnished and Put up to Plans and Specifications,

LARGE STOCK ON HAND OF

**Wires, Batteries, Insulators, Electric Light Wire and Supplies.**

Send for Illustrated Catalogue and Special Prices,

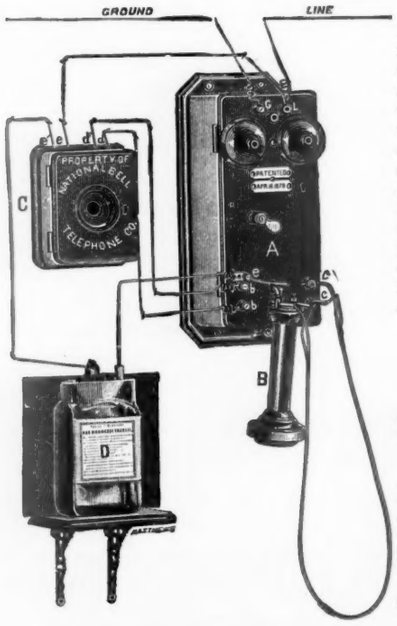
STANDARD ELECTRICAL WORKS,

Cincinnati, Ohio, U. S. A.

THE

# American Bell Telephone Co.

WM. H. FORBES, *President.* THEO. N. VAIL, *Gen'l Manager.* WM. R. DRIVER, *Treasurer.*




This Company owns the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents, covering improvements upon the same, and controls, except for certain limited territory, under an arrangement with the Western Union Telegraph Co., the Gold and Stock Telegraph Co., the American Speaking Telephone Co., and the Harmonic Telegraph Co., the Patents owned by those Companies, and is prepared to furnish telephones to the citizens of the United States through its local Licensees, on the following systems:

## EXCHANGE, PRIVATE LINE, & SPEAKING TUBE LINES

*Those desiring instruments on Private or Speaking Tube Lines, or connections on Exchanges, will please apply to the nearest Licensed Exchange, when their case will be brought to the attention of the proper local Company.*

*Any further information will be gladly furnished on application to the Company at its office,*

**No. 95 MILK STREET, BOSTON, MASS.**

All persons using telephones not licensed by this Company, are hereby respectfully notified, that they are liable to prosecution, and for damages for infringement, and will be prosecuted according to the full extent of the law.

## THE THOMSON-HOUSTON ELECTRIC CO.

FURNISHES THE

ONLY PERFECT, AUTOMATIC, SELF-REGULATING SYSTEM OF ELECTRIC ARC-LIGHTING IN THE WORLD.

In all desirable qualities of ELECTRIC ARC LIGHTS the THOMSON-HOUSTON SYSTEM has no equal. The lights are *superior in color and steadiness*, and the entire apparatus is more *economical, efficient* and *safe*, more *easily managed*, and *less liable to derangement* than any other

**Principal Office, 131 Devonshire St., Boston, Mass.**

H. A. PEVEAR, President. C. A. COFFIN, Vice-President. S. A. BARTON, Treas. and Manager. J. J. SKINNER, Secretary. E. THOMSON, Electrician. E. J. HOUSTON, Consult'g Electrician.

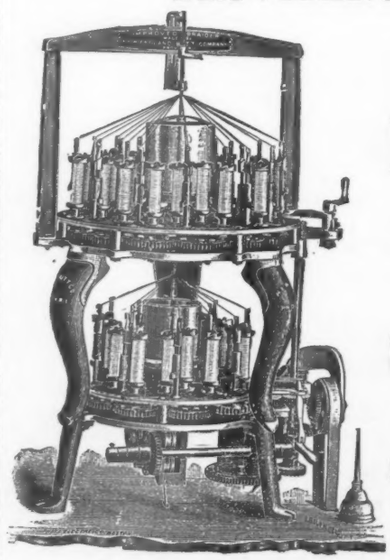
DIRECTORS:

H. A. PEVEAR, C. A. COFFIN, B. F. SPINNEY, J. N. SMITH, S. A. BARTON, E. THOMSON

New Illustrated Pamphlet will be sent on application.

# NEW ENGLAND BUTT CO.

PROVIDENCE, R. I.



MANUFACTURERS OF

## BRAIDING MACHINERY

FOR COVERING

**Telegraph, Telephone and Electric Light Wire**

ALSO

**SINGLE AND DOUBLE WINDERS**

AND

Braiders of every description,

For Silk, Worsted and Cotton Braid.

**FINE CASTINGS**

A SPECIALTY.

# The Coe Brass Mfg. Co.

MANUFACTURERS OF

BRASS,

Copper & German Silver,

IN EVERY VARIETY OF

SHEETS, ROLLS, PLATES, WIRE, RODS & BLANKS OR SHELLS,

Pure Lake Superior Copper Wire

A SPECIALTY,

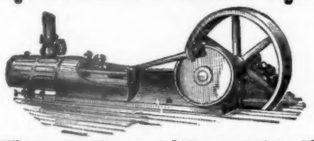
**BATTERY ZINCS.**

TORRINGTON, Litchfield Co., CONN., U. S. A.

---

**THE PAYNE**

**Single and Double Valve Automatic Engine.**



Will guarantee 20 per cent. better regulation with our *single slide valve automatic engine* than can be attained by any other engine in the market. For sale by E. P. Hampon & Co., 26 Cortlandt St., N. Y., Hill, Clark & Co., Boston, Mass. Write for Circular No. 36. B.W. Payne & Sons, Box 1450, Corning, N.Y.

---

# LECLANCHE.

Prism Battery, Complete Size of Jar, 6x4½ inches.

THE GREAT

**Telephone Battery.**

THE STANDARD OPEN CIRCUIT BATTERY OF THE WORLD.

Over 500,000 cells now in use in the United States and 1,000,000 in Europe.

ADOPTED BY ALL THE

TELEPHONE COMPANIES.

THE SIMPLEST, CLEANEST, MOST DURABLE, MOST ECONOMICAL.

Beware of Infringements and Cheap Imitations.

LECLANCHÉ BATTERY CO.

149 W. 18th St., N. Y., or

L. G. TILLOTSON & CO., 5 & 7 Dey St., N. Y.

---

**SPENCERIAN INK**

Extra Black, Blue Black, and Copying, all of superior quality, claiming Special excellence in the essentials of Fluidity, Color and Durability. Circulars free.

Ivison, Blakeman, Taylor & Co., N. Y.

---

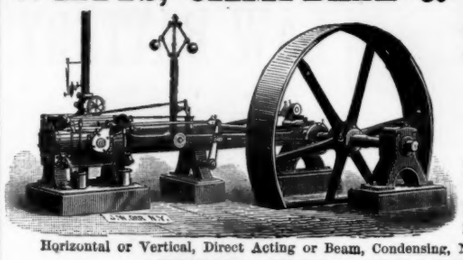
# WATTS, CAMPBELL & CO., NEWARK, N. J.

MANUFACTURERS OF

**Improved Corliss STEAM ENGINES**

IN FULL VARIETY.

Sizes varying from 30 to 2000 H P.



Preferred above all others by the United States and Brush Electric Lighting Co.'s for regularity of speed and economy.

Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound

**SEND FOR CIRCULAR.**

---

# Holmes, Booth and Haydens,

MANUFACTURERS OF

FIREPROOF ELECTRIC LIGHT WIRE,

From Pure Lake Superior Copper—Conductivity Guaranteed.

PATENT

"K. K." Insulated Copper and Iron Wire,

For Telephone and Telegraph Use,

Gen'l Agents for the Pittsburgh Carbon Co.

(LIMITED.)

**49 CHAMBERS STREET, NEW YORK,**

**18 FEDERAL STREET, BOSTON.**

WORKS AT WATERBURY, CONN.

---

---

# VICTOR BISHOP & CO.,

IMPORTERS OF DIAMONDS,

# PLATINUM

**For all Manufacturing, Chemical, Electrical, Dental, and Laboratory purposes.**

Victor Bishop & Co.,

ESTABLISHED 1837. No. 33 MAIDEN LANE, NEW YORK.

---

**LOCKWOOD & FOSTER'S**

# NEW TELEGRAPH SOUNDER AND KEY.

Price by Mail prepaid $2.00.

By Express not prepaid $1.50.

SEND 75c. FOR ELECTRIC BELL. NAME CAPACITY REQUIRED IN YOUR ORDER.

January 22, 1884

The undersigned have thoroughly tested the "Lockwood & Foster Telegraph Sounder and Key," and Electric Bell, and find them both reliable, practical, working instruments. We therefore endorse them as the best and cheapest in the market.

Signed, THE FREEMAN ELECTRICAL M'F'G Co., 181 William St., N. Y.

S. D. MOTT, Electrical Draughtsman and Expert, 59 Astor House, N. Y.

Address all communications to LOCKWOOD & FOSTER, 21 Park Row, N. Y.

---

# A. C. NORTHROP,

Waterbury, Conn.

Iron and Brass Machine Screws

ZINC IN SHEETS AND PLATE FOR ELECTRICAL PURPOSES.

Parts for Telegraph and Telephone Instruments,

MANUFACTURED FROM

Iron, Brass, Steel, or Zinc.

Opportunity to Estimate on patented articles from Sheet Metal, Rod or Brass Castings, respectfully solicited.

---

**H. M. RAYNOR,**

No. 25 Bond Street, New York.

ESTABLISHED 1859.

PLATINUM IN All Forms FOR ALL PURPOSES,

Wholesale and Retail

---

ESTABLISHED 1864.

# WILLIAM A. HARRIS

MANUFACTURER OF

**HARRIS-CORLISS**

**STEAM ENGINES**

With Harris' Patented Improvements

ALSO

Light and Heavy Iron Castings,

PROVIDENCE, R. I.

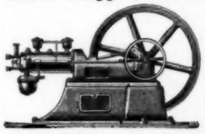
¶Send for copy "Engineers' and Steam Users' Manual," by John W. Hill, M. E. Price, $1.25.

---

# "OTTO" GAS ENGINE

OVER 10,000 IN USE.

**Started Instantly by a Match. When Stopped all Expense Ceases.**



Works without boiler, steam, coal, ashes or attendance. Successfully adapted instead of steam power in all industries and offers special advantages for running electrical machinery for Telegraph and Telephone as well as Lighting purposes.

Built in Sizes of 1, 2, 4, 7, 10, 15 & 25 ind. H. P.

**SCHLEICHER, SCHUMM & CO.**

N. E. cor. 33d & Walnut, Phila.

Branch Office: 214 Randolph Street, Chicago.

---

**THE FISKE & MOTT**

# High Resistance Insulator

We will be ready to fill orders after January 15th in order of receipt—in glass or of our patent composition.

For long lines, or wherever HIGH INSULATION is required, they are unequaled.

For prices, catalogues, etc., address,

**THE CHICAGO INSULATING CO.,**

**122 La Salle St., Chicago, Ill.**

**MEMBERSHIPS.**

At a meeting of the Directors of the

**Electric, Manufacturing & Miscellaneous STOCK EXCHANGE,**

It was resolved to close the subscription books for the first limited allotment of seats at $250, on or before Nov. 17th, prior to opening of the Exchange.

Application blanks may be had of and subscriptions made through and payable to the order of

The Third National Bank, No. 20 Nassau Street.
The St. Nicholas Bank, of N. Y., No. 7 Wall St.
The Chatham National Bank, No. 196 Broadway, or Messrs. Hagen & Billings, bankers, No. 1 Wall St.

All applications must be accompanied by check and name and address of applicant. (The right to reject reserved.) Subscriptions can also be made to, and information obtained of, the Secretary, Duncan Building, No. 11 Pine Street.

# TO INVESTORS.

The KEITH ELECTRIC COMPANY having secured and paid for valuable patents covering a complete system of Electric Lighting, and having demonstrated the economy and reliability of their light, are now prepared to push its introduction with the utmost energy. For this purpose a limited amount of the stock is offered for sale at $20 per share. For full particulars address,

* AUSTIN GALLAGHER,
DREXEL BUILDING,
Cor. Wall and Broad Sts., N. Y.

* Refers to Proprietors of the ELECTRICAL REVIEW.

**MUTUAL**

## DISTRICT MESSENGER COMPANY,

—) OF BOSTON. (—

Principal Office, Old State House, State Street, Boston, Mass.

J. M. PRENDERGAST, President,
D. J. HERN, Gen. Manager. W. H. SMITH, Sup't

DEPARTMENT FOR THE

**Addressing and Distribution of Circulars.**

NOTICE TO ADVERTISERS AND OTHERS.

We have in our employ experienced persons to address, fold and envelope advertising matter for distribution by mail or by our messengers.

We distribute Circulars, Handbills, Notices, etc., PROPERLY, and at less rate than can be done by any other manner, considering the thoroughness of our work.

SPECIAL arrangements made for any respectable kind of service; well drilled and neatly uniformed messengers employed to do the same. Will furnish estimates for delivering circulars, etc., to any city or town in Massachusetts.

OUR RATES FOR DELIVERY IN BOSTON ARE AS FOLLOWS:

| | | |
|---|---|---|
| Handbills, delivered on the Street, | $1.00 per 1000 | |
| " " in the Stores, | 1.50 | " |
| Unaddressed Circulars, (in envelopes) | 3.50 | " |
| " " " 2,000 to 5,000, | $3.00 | " |
| Addressed Circulars, | 7.00 | " |
| " " 2,000 to 10,000, | 6.00 | " |
| " " 10,000 to 25,000, | 5.00 | " |
| Pamphlets, (small), delivered on Street | 4.50 | " |
| " " " in Houses | 6.50 | " |
| " (large). " on Street | 6.00 | " |
| " " " in Houses | 8.00 | " |

Our price for addressing, folding, and mailing, (including envelopes and postage) is $20.00 per thousand for ordinary circulars of not more than 2 ounces. Special rates on lots above 10,000, and on books and other heavy advertising matter.

# SPIRAL
# TELEPHONE
# WIRE.

**For Long & Short Distance Telephoning**

*Patents allowed April 24, July 25, 1883.*

**American Spiral Telephone Wire Company,**

43 Milk Street,

**BOSTON, MASS.**

## American Electrical Works

MANUFACTURERS OF

**Patent Finished Insulated**

## Electric Wires,

**TELEPHONE AND ELECTRIC CORDAGE,**

ELECTRIC LIGHT WIRE

**MAGNET WIRE,**

PATENT RUBBER COVERED WIRE, BURGLAR ALARM AND ANNUNCIATOR WIRE, LEAD-ENCASED WIRE, ANTI-INDUCTION AERIAL AND UNDERGROUND CABLES ETC., ETC.

OFFICE AND FACTORY:
No. 67 STEWART STREET,
**PROVIDENCE, R. I.**
EUGENE F. PHILLIPS, President.
W. H. SAWYER, Secretary and Electrician.

## PARTRICK & CARTER,

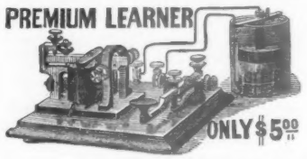
Philadelphia, Pa.,

MANUFACTURERS OF

**Telephone, Telegraph**

And Electrical Instruments and Supplies.

Among our SPECIALTIES are the CELEBRATED




Not the Cheapest, but GUARANTEED THE BEST.

COMPLETE OUTFIT ONLY $5.00.

**The Fitch Chlorine Battery,** patented Sept 16, 1879, acknowledged the **Best** Battery in use for Telephones, Annunciators, Call Bells, etc. Price, $1.50 per cell. Liberal discount to the trade.

**The Acme Steel Lever Key,** best and most perfect Key ever placed before the telegraphic profession; endorsed by hundreds of the most expert telegraphers in the country. Price by mail, $3 00.

The **Original Giant Sounder,** price $4.00 by mail. Send for our catalogues and price lists. Correspondence solicited.

PARTRICK & CARTER,

*Telephone, Telegraph & Electrical Instruments and Supplies of every description,*

114 SOUTH 2d ST., PHILADELPHIA, PA.

THE

## LAW BATTERY.

**The BEST Open Circuit Battery in the World and the CHEAPEST.**

Combines all the advantages of the best of the others, without any of their disadvantages. Thousands sold monthly. Send for circular. Manufactured and sold by the

**LAW TELEGRAPH CO.,**

140 Fulton St., New York.

## ALFRED F. MOORE,

MANUFACTURER OF

## Insulated Wire,

—FOR—

**Telephone, Telegraph and Electric Light,**

OFFICE, LINE,

—AND—

**ANNUNCIATOR WIRE,**

**Magnet Wire and Flexible Cordage,**

**200 & 202 N. THIRD ST.,**

PHILADELPHIA, PA.

## PHOSPHOR-BRONZE

**TELEPHONE WIRE,**

**Insulated and Bare.**

*"Phosphor-Bronze."*

Combines High Electrical Conductivity and Resistance to Corrosion with Lightness and Tenacity.

**Standard Sizes, 16, 17, and 18, Stubs' Gauge.**

ADDRESS;

**The Phosphor-Bronze Smelting Co. (limited,)**

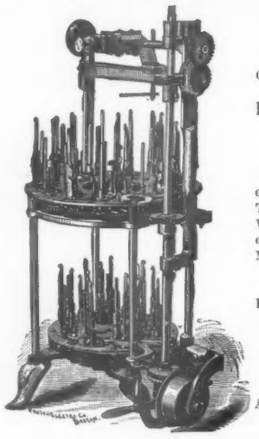
**512 ARCH ST., PHILADELPHIA, PA.**

Owners - of - the - United - States - Phosphor-Bronze - Patents.

Sole Manufacturers of Phosphor-Bronze in the United States.

## Rhode Island Braiding Machine Co.

**89 ABORN ST., PROVIDENCE, R. I.**



General Machinists.

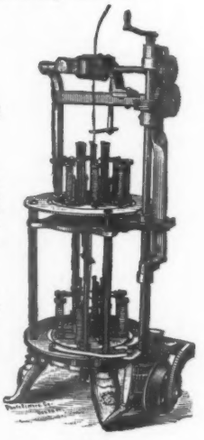
Our Specialty being in

**Braiding & Winding Machinery,**

Braiders and Winders for covering all kinds of Telegraph, Telephone, and Electric Light Wire, and for making all sizes of Worsted, Silk, Cotton and Mohair Braid.

**Packing Braiders, Coir Matting Braiders, Quillers, Hankers, Measuring Machines, &c., &c.**

Also a full stock of Spools, Bobbins, and Braiders' Supplies.



## THE ELECTRIC STORAGE AND LIGHT CO.

**95 Milk St., Boston, Mass.**

Organized under the Laws of Massachusetts,

OWN THE PATENTS FOR

**Faure's Storage Batteries,**

OR

**Electrical Energy Accumulators,**

FOR

**MASSACHUSETTS, RHODE ISLAND AND CONNECTICUT.**

## THE MILITARY TELEGRAPH

DURING THE CIVIL WAR.

BY WILLIAM R. PLUM, LL.B.

Two Volumes, Cloth, Illustrated, $5.00

DELANO & COMPANY, Publishers,
No. 23 PARK ROW,
P. O. Box 3329. NEW YORK.

MANUFACTURER OF SUPERIOR

**CARBON POINTS AND PLATES.**

## BUFFALO ELECTRIC WORKS

1590 to 1620

NIAGARA STREET,

BUFFALO, N. Y.

ИЛЛЮСТРИРОВАННЫЕ КАТАЛОГИ
EXECUTED
IN FIRST CLASS STYLE AND WITH DESPATCH
*O.W. MADDAUS*
DESIGNER AND ENGRAVER ON WOOD
23 PARK ROW NEW YORK.

## BOULTON CARBONS.

These carbons are made of the

**BEST MATERIALS,**

and with the latest improved machinery, of **any required degree of hardness,** and can be used in all makes of Electric Lamps.

The regular sizes, 12 inches long, run from ¼ inch to 1 inch in diameter, varying by sixteenths.

**Special Lengths and Sizes to Order.**

A large and complete stock always on hand.

The want of a high order of battery plate has long been felt. Those wishing such would do well to use the

**BOULTON PLATES.**

Special attention is given to the manufacture of all sizes to order.

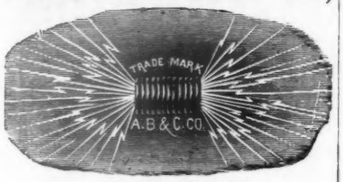
Price-Lists and full information furnished on application.

## BOULTON CARBON WORKS,

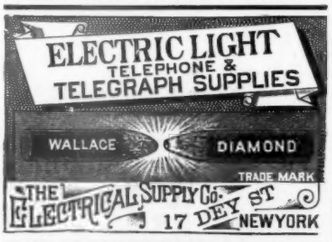
PAYNE AVENUE,
CLEVELAND, O.

THE
**TRENTON IRON CO.**
MANUFACTURERS OF
**GALVANIZED IRON WIRE**
OF VARIOUS GRADES FOR
**Telegraph and Telephone Lines.**
WORKS AND OFFICE AT
**TRENTON, NEW JERSEY**
NEW YORK OFFICE:
Cooper, Hewitt & Co., 17 Burling Slip.
PHILADELPHIA OFFICE:
21 NORTH FOURTH STREET.

THE ANSONIA
**BRASS & COPPER CO.,**




MANUFACTURERS OF
**Pure Electric Copper Wire,**
For Magnets, Telephones, Electric Lights, etc.
WITH H. SPLITDORF'S PATENTED LIQUID INSULATION COVERED WITH COTTON OR SILK.
**LINE WIRE.**
**Fire Proof House and Office Wire**
For Indoor use in Electric Lighting.
Wrought Metal Gongs for Annunciators, Telephones, &c.
ZINC RODS, BATTERY COPPER &c
Nos. 19 and 21 Cliff St., New York.

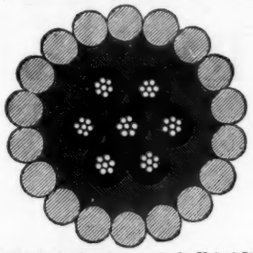



WESTERN
**Electric Company**
CHICAGO, BOSTON, NEW YORK,
MANUFACTURERS OF
**TELEGRAPH INSTRUMENTS AND SUPPLIES,**
Insulated Copper Wires, Electric Bells and Annunciators, Burglar Alarms, the Electro-Mercurial Fire Alarm, Electro-Medical Apparatus, Electric Gas Lighting Apparatus, Edison's Electric Pen and Duplicating Press, the Gamewell Fire Alarm Telegraph Apparatus, Bi-Polar and Carbon Telephones, Telephone Exchange Apparatus, Underground Cables.
ANSON STAGER, President. ENOS M. BARTON, Vice-President.

**CATALOGUES**
**SENT BY MAIL ON RECEIPT OF PRICE IN STAMPS OR CURRENCY.**

| | Pages. | Price. |
|---|---|---|
| I—Complete set of Catalogues | 236 | 20c. |
| II—Telegraph Instruments and Supplies | 64 | 6c. |
| IV—Insulated Wire (included in II.) | | |
| V—Electric Bells, Annunciators, Electro-Mercurial Fire Alarm | 32 | 3c. |
| VI—Electro-Medical apparatus | 32 | |
| VII—Manual of Telegraphy and Catalogue of Private Line Instruments | 32 | free. |
| VIII—Condensed Price List | 20 | free. |
| X—Electric Bells, etc., descriptive | 12 | 3c. |
| XI—Magnets for Mills | 20 | 3c. |
| Sir William Thomson's Nautical Instruments | 24 | 5c. |

**The Bishop Gutta-Percha WORKS.**
SAMUEL BOARDMAN, Agent.)



Original and only Manufacturers in the United States.
**GUTTA-PERCHA INSULATED**
Submarine Telegraph Cables,
50 Regular Sizes. One to Ten Conductors.
Subterranean Telegraph Cables,
Hempen-Armored Covered.
Aerial Telegraph Cables,
Lead or Hempen Covered.
**ANTI-INDUCTION**
Telephone (Lead-Covered) Cables,
as used by the Metropolitan Telephone & Telegraph Co.
Torpedo Cables,
Recommended by the European and South American Governments.
Lead-Covered Cables,
For Canal and Streamlet Crossings.
Gutta-Percha Office Wire, Leading and Connecting Wire,
For Subaqueous Mining and all other Electrical purposes.
Mark's Compound Insulated Wire,
For Office, Outdoor, Underground, and Battery Use.
G. P. Office Wire, Cotton-Covered.
ALSO HAVE ALWAYS ON HAND:
**Wires of every variety of Insulation,**
Magnet Wire, Telephone Flexible Cords, Flexible Elevator Cables, Electric Cordage, Burglar-Alarm and Annunciator Wire, Electric Light Wire, Cordage and Cables, Lead-Covered Wire, and every description of pure Gutta-Percha goods, Gutta-Percha Sheet, for Cable Splices; G. P. Chemical Vessels for Acids, etc.
Agents for Reception of Orders and Sale of Goods:
L. G. TILLOTSON & CO., 5 & 7 Dey St., New York.
WILLIAM HEATON, 503 Chestnut St., Phila.
Thirty-three years' experience has taught us that neither the electrical nor mechanical qualities of either Gutta-Percha or Copper deteriorate by long working or submersion, consequently the best form of a Submarine Telegraph cable will be that in which these conditions were fulfilled.—*Extract from Report on Cables, by Willoughby Smith.*
MANUFACTURED BY
**The Bishop Gutta-Percha Works.**
Address all communications to
W. W. MARKS, Superintendent,
420, 422, 424 & 426 East 25th St., N. Y.
OFFICE AT THE WORKS.

**Rhode Island Telephone and Electric Co.**
PROVIDENCE, R. I.,
MANUFACTURERS OF THE
*Providence Telephone Switch-Boards,*
BRECKENRIDGE JACKS,
Wright Cable Clips,
**Howard Safety Appliance,**
For protection to telephone subscribers against Lightning or Electric Light currents.
Dealers in Electric Appliances of every description.
Manufacturers and constructors of Lightning Rods upon scientific principles.
Licensees of The Time Telegraph Co. of New York for the New England States. Energetic men with capital wanted to form local plants in territory not yet disposed of.
Correspondence solicited from inventors, or parties having electrical novelties, with a view either to purchase or introduction as agents.
HENRY HOWARD, President.
C. T. HOWARD, Treasurer.
J. W. DUXBURY, Sec'y and Gen. Manager.
F. H. GARDINER, Assistant Manager.

S. W. FRENCH, President. W. C. DEWEY, Treasurer. FRANK F. BULLARD, Gen'l Manager.
**PALMER WIRE COMPANY**
PALMER, MASSACHUSETTS.

**GALVANIZED**
**Telegraph & Telephone Wire**
In Long Lengths, by our Continuous Process, and Pronounced by all Users as Unsurpassed in
QUALITY OF MATERIAL, FINISH AND CONDUCTIVITY.
Testimonials of same furnished if required. Line Men have less trouble with our Wire than with any other make. Put up in Half Mile Lengths.
Approximate diameter of Wire drawn by PALMER WIRE GAUGE, in thousandths parts of an inch.

| | | | | |
|---|---|---|---|---|
| No. 4—.225 | No. 7—.177 | No. 10—.135 | No. 13—.092 | No. 16—.063 |
| No. 5—.207 | No. 8—.162 | No. 11—.120 | No. 14—.080 | No. 17—.054 |
| No. 6—.192 | No. 9—.148 | No. 12—.105 | No. 15—.072 | No. 18—.047 |

Estimates on complete equipment of Private Lines furnished on application. Correspondence solicited.
**New York Office, 20 Cliff Street.**

JOHN H. MUEGGE,
IMPORTER OF
**PLATINUM.**
Manufacturer of all kinds of Chemical Apparatus Crucibles, Vessels, &c., Wire for Electrical Purposes Plate and Wire for Dentists. Scraps Purchased.
No. 91 Liberty St., New York.

**BUTLER'S SAFES**
FIRE & BURGLAR PROOF.
291 BROADWAY,
NEW YORK.

THE
**United States Electric Lighting Co.**
SOLE MANUFACTURERS OF
**WESTON DYNAMO-ELECTRIC MACHINES**
For both Arc and Incandescent Lighting.
**WESTON ARC LAMPS, AUTOMATIC REGULATORS, FIXTURES, CARBONS, &c.**
**MAXIM INCANDESCENT LAMP.**
*And all Apparatus necessary for the most COMPLETE, EFFICIENT and RELIABLE SYSTEMS of Electric Arc and Incandescent Lighting.*
**OFFICE: 59 & 61 LIBERTY ST., NEW YORK.**
George W. Hebard, *Pres.* Leonard E. Curtis, *Sec.* Ph. Ferd. Koblé, *Treas.*
TRUSTEES:
Marcellus Hartley, Edward Weston, Henry B. Hyde, Anson Phelps Stokes,
Walter T. Hatch, John A. Stewart, Charles R. Flint, Henry Day,
Robert B. Minturn, Louis Fitzgerald, George W. Hebard, Leonard E. Curtis,
Thomas H. Hubbard.
☞ SEND FOR CATALOGUE. ☜
**Perfect Automatic Regulation in both Systems.**

# WESTERN ELECTRIC COMPANY,

CHICAGO—BOSTON—NEW YORK.

**Telegraph and Telephone Apparatus and Supplies.**

The Best of everything at Bottom Prices.

# A. G. DAY,

Manufacturer of

Kerite Insulated

**Telegraph and Telephone**

*Wire and Cables.*

OFFICE, 120 BROADWAY, NEW YORK.

FACTORY, SEYMOUR, CONN.

**ANTI-INDUCTION KERITE**

Telephone Cables.

*Some of them Two Miles in Length, are in use in several cities, and are found to WORK PERFECTLY for that distance.*

**Eminent Electricians and Practical Telegraphists**

Commend and recognize the Kerite Insulation as superior to all others. At the CENTENNIAL EXHIBITION at Philadelphia, SIR WILLIAM THOMSON, the eminent Electrician and scientist, awarded to the

**Kerite Insulated Wire and Cables**

A DIPLOMA

For "Excellence of the Insulation and Durability of the Insulator."

GENERAL AGENT:

CLARK B. HOTCHKISS

120 BROADWAY, NEW YORK.

# CHARLES WILLIAMS, JR.

(Established in 1856.)

Nos. 109-115 Court Street,

BOSTON, MASS.

AUTHORIZED MANUFACTURER OF

**THE AMERICAN**

**BELL TELEPHONE CO.**

Magneto, Crank and Push Button

**CALL BELLS,**

**ELECTRIC BELLS,**

**DISTRICT BELLS**

AND

Switches for Exchanges, Annunciators, &c.

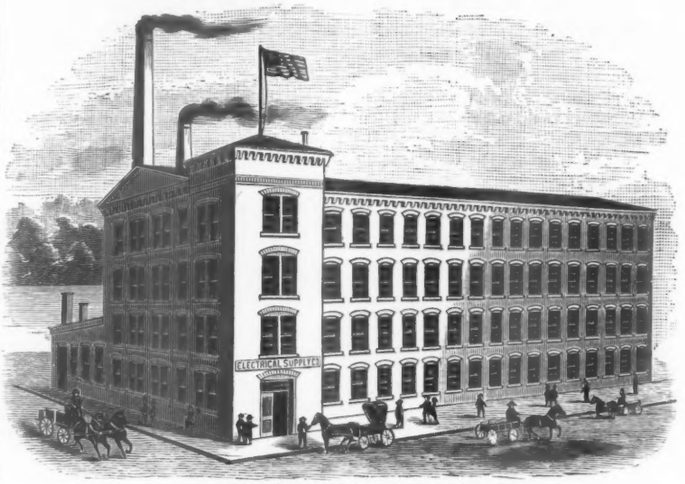
Telegraph and Electrical Instruments, Batteries, Wire, Insulators, and Telephone Supplies of every description.

# THE ELECTRICAL SUPPLY CO.

MANUFACTURERS OF

# Insulated Wire

OF EVERY DESCRIPTION.




(Factory of the Electrical Supply Co. at Ansonia, Ct.)

## ELECTRIC LIGHT, TELEPHONE, AND TELEGRAPH SUPPLIES.

Warehouse: 17 DEY ST., NEW YORK.

FOR **ELECTRIC LIGHTING** Unequalled.

FOR **GENERAL USE** Unexcelled.

# THE BRUSH ELECTRIC CO., CLEVELAND, OHIO.

**The Sole Manufacturers under all the Patents of Chas. F. Brush for Electric Lighting, Storage Batteries, &c.**

We furnish the only complete and PERFCT SYSTEM of electric lighting.

**The best DYNAMO Machines. The ONLY PRACTICAL Storage Batteries.**

**The best arc lamps. The purest and best Carbons, &c.**

Our prices are the lowest, our factory the largest and our business the most extensive in the world to-day.

SEE THE LIST. **ELECTRIC LIGHT MACHINES. Standard Sizes.**

| No. of Mch. | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of lights 2,000 c.p. | 1 | | 2 | | 4 | | 10 | | 20 | | 30 | | 65 |
| No. of lights 1,200 c.p. | | 2 | | 3 | | 6 | | 15 | | 30 | | 45 | |
| H.P. required. | 1½ | 1½ | 3 | 3 | 4 | 4 | 8 | 8 | 14 | 14 | 22 | 22 | 45 |
| Price, | $300.00 | $300.00 | $415.00 | $415.00 | $565.00 | $565.00 | $900.00 | $900.00 | $1,500.00 | $1,500.00 | $2,000.00 | $2,000.00 | $3,600.00 |

Single Lamps $50.00. Double Lamps $60.00. Send for details.

The Brush Electric Company, No. 104 Euclid Ave., Cleveland, Ohio.

# INCANDESCENT LIGHTS

SWAN INCANDESCENT ELECTRIC LIGHT CO.

OWNERS OF THE

**SWAN PATENTS FOR THE UNITED STATES,**

ARE PREPARED TO GRANT LICENSES TO COMPANIES TO SELL AND USE THE SWAN INCANDESCENT LAMP, INCLUDING OUR PATENTED HOLDERS, SWITCHES, CUT-OFFS, ETC. WE GUARANTEE OUR LAMP AND TO DEFEND THE VALIDITY OF OUR PATENTS. FOR TERMS OR INFORMATION, APPLY TO

**THE SWAN INCANDESCENT ELECTRIC LIGHT CO.,**

**253 Broadway, Cor. 14th Street, New York**